NSTRUCTION: THROW THE R/C JAVELIN!

June 1990

MODEL AIRPLANE NEWS

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THE WORLD'S PREMIER R/C MODELING MAGAZINE

Canada $3.75

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- EZ Bell 222 Conversion
- Assembling Bodies

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JUNE 1990 VOLUME 118, NUMBER 6

MODEL AIRPLANE NEWS

ON THE COVER: Dominating the cover this month is Ron Farkas's Hirobo Shuttle. It's understandable if you didn't recognize it: Ron shrouded the mechanics with the Sports Aviation EZ Bell 222 conversion body. With the popularity of the new, smaller-size helis on the rise, scale bodies of this type are finding wide acceptance. Ron takes you through the conversion in this issue's Heli Section. Above the Bell, we find Pappy deBolt launching his latest electric, the Javelin, which is the subject of our construction article. Kodachromes by Rich Uravitch and Hal deBolt.

FEATURES

CONSTRUCTION

HELICOPTER SECTION

COLUMNS

COLUMNS

DEPARTMENTS

EDITORIAL

by RICH URAVITCH

LAST MONTH, I encouraged you to attend as many trade shows as you can, because they're ideal places to see what manufacturers are introducing, or thinking about introducing. At these shows, you can touch, feel, prod and poke (and that applies to the R/C models also!), and perhaps enjoy that once-a-year opportunity to meet others who, despite your mutual interests, you see only once a year.

Just like last month, I'm again between trade shows—this time, the RCHTA show (Pomona, CA) and the granddaddy of all R/C shows—*Toledo*. It's interesting to note just how much the shows have changed over the years—and how much they've remained the same!

I was invited to give a *general* presentation on R/C airplanes at the RCHTA show, and I thought this was a little curious—after all, it was an R/C show wasn't it? Well, just to be sure, I first asked the audience, "How many of you have built or flown an R/C airplane?" I wanted to determine where I could start my sermon; didn't want to bore anyone with the really *basic* stuff, did I? Surprise! Only about half of the folks raised their hands! Obviously, a surprising number of non-modelers (at the moment) attend shows, and each is there because *something* sparked his interest. Granted, some might have attended this show because it was an overcast, damp day in LA and they had nothing better to do, but no one made them sit in at my presentation. *They were interested*, and each of us should take the opportunity to help anyone who shows that interest to get started in R/C.

It's flying season now in nearly every area of the country, including here in Connecticut, and it's a fine time to get others involved. Answer the questions that newcomer to your field may ask. Remember, you once walked in his moccasins. We'll all be the beneficiaries. ■

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AIRWAVES

WHERE TO WRITE TO US: If you're writing to the editors (and we'd love to hear from you), please be sure to address your letters to "Airwaves" *Model Airplane News*, 251 Danbury Road, Wilton, CT 06897. Only subscription orders and inquiries are handled by our Customer Service Department in Mount Morris, IL; other mail addressed there must be forwarded to Connecticut, and this leads to long delays.

BUDDING BRAZILIAN AEROMODELERS

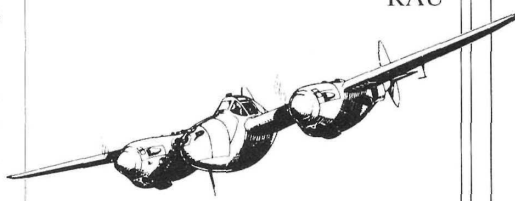
Several years ago, I spoke to you at the Toledo show and mentioned that I had some pictures you might enjoy. I recently ran across your card and decided I'd send these photos to you.

I work in North Brazil as a pilot/mechanic, and I transport missionaries who work in the jungle. As a model-airplane fan since I was five years old, I've been fascinated with the Indians' interest in model planes. It seems that in every tribe, the kids are designing and building their own. They love to hold their models behind our Cessna 206 and let the prop blast spin the little props on the models. Jungle fruits provide "wheels." I've seen "multi-engine" models, too. They loved it when I took the R/C plane out to show them and, one time, I flew U-control in the center of their round house. Hope you enjoy the pictures.

BILL LUBKEMANN
C.P. 165
69 300 Boa Vista, RR.
Brazil, South America

Bill, thanks so much for the pictures. It's really gratifying to see just how much an influence aeromodeling is worldwide. You're certainly to be congratulated for introducing this group of Yanomami Indians to many of the things we take for granted. We often lose sight of just how much we have available to us. I guess it evens out though—they probably don't have to deal with problems like frequency control, noise abatement and loss of flying sites. Thanks again.

RAU



LOOKING FOR LIGHTNING

Help! I'm looking for your plan no. 227 C/L Scale Nats winner P-38 that consists of two plates and features electric retracts; circa June 1965. I called your plans service, and they were extremely helpful, but they didn't have the plan. I have a set, but they're faded and partially illegible, and I misplaced the plate for retracts. I want to convert to R/C. Where can I obtain the plans, if not from you? I'm desperate!

DAVAGE MILLER JR.
1165 Lilley Ave.,
Columbus, OH 43206-1735
(614) 252-7069

Sorry, Davage, as good as our archives may be, most of the C/L designs that we once offered have long disappeared from our plans inventory. Your letter is typical of many we receive requesting some of our

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AIRWAVES

(Continued from page 8)

old plans. Like the P-38, the designs themselves are dated, and the construction techniques and materials are nowhere near present standards. This is especially true when the design involves scale R/C. So much has happened over the past 25 years, particularly in the area of accuracy, that designs once considered to be "exact scale" would now fall short of the mark. I appreciate your quest for a specific design, so I'm printing your complete address; maybe another reader will have no. 227 in his plans inventory. Let us know how you make out. RAU

MORE ON "THE MONSTER"

In reference to George Sauer's inquiry about plans for the Custom Privateer (or "McGovern's Monster"): John Pond (4269 Sayoko Circle, San Jose, CA 95136) is the present source of plans. I own a set, but it came from the now-defunct Model Plan Service. For a current price, contact John. As many modelers know, he supplies many old-time plans and may well be the only source of designs you thought had disappeared. He has always been a prime mover in the Society of Antique Modelers (SAM) of which I'm a member, along with the AMA.

ALVIN E. JOHNSON
Oxford, PA

Alvin, you're absolutely right. John Pond is an often overlooked source of vintage plan reproductions. I've seen his listing, and it's impressive. It contains plans for some designs that haven't been available in quite some time. Thanks for the input, I'm sure our readers will find it helpful. RAU

WHERE HAVE ALL THE HBs GONE?

I have two nice HB .25 R/C motors that are badly in need of bearing sets. Who still handles parts for these engines? The HB motors were of superb quality and gave me years of dependable use. (Behind a modified Eaglet, I was able to tow aloft 360 feet of crepe streamer! On takeoff, I had to retract the flaps slightly to get rid of a little drag and get me into ground effect where I could milk-up the flaps and start to climb.) While both motors were occasionally asked to do the impossible, they're still in great shape (except for the bearings), and I'd like to get them running again. Any sources?

RAY STARK
1507 W. Sherri Dr.
Gilbert, AZ 85234
(602) 497-5191

Ray, the HB engines have always been good reliable powerplants, but they never really did find a solid "home" for distribution in the U.S. As a result, a lot of the ones that require parts are gathering dust on modelers' shelves. Clean them off, because we hear that RJL Industries (P.O. Box 5, Sierra Madre, CA 91025, 818-359-0016) offers factory parts and service. Contact them for your needs. If that doesn't work, try the longer route: contact the factory at HB Feinmechanik, D-8354 Metten, West Germany. Gentlemen, start your engines! RAU

COUNTER-REVELATION

I read *MAN* and find it very informative. I'm interested in building a Martin Baker M.B.-5, which has a contra-rotating airscrew. I need some information about it. I'm not really sure how a contra-rotating airscrew works. Does anybody pro-

duce a gearbox assembly that would hook-up to an engine to turn both props? Also, is one engine required for each prop, or will one engine turn both? I think this is a very interesting project. Any information you supply will be greatly appreciated.

SAMUEL A. BAGBY, JR.
Gloverville, SC

Sam, originally from Britain, the M.B.-5 used a contra-rotating airscrew; here, on this side of the pond, we call it a "counter-rotating" prop. In either case, a single engine drives a pair of props in opposite directions through a gearbox. Most recently, the system has been seen on the UDF (Unducted Fan) project, experimented with by G.E. on a modified MD-80 airliner. The RB-51 "Red Baron" racer also used the counter-rotating arrangement to couple its Griffon engine to the props. I recall an article in Scale R/C Modeler a while back that describes a system being hand-made for models, but I don't know what the outcome was. I suspect that the complexity, reliability and probable high cost gave way to more conventional propulsion arrangements. Glad you find MAN informative—that's what we're here for. RAU

VIKING FAN FROM TENNESSEE

I recently purchased the December '89 issue of *MAN*. In your article, "The British International Ducted-Fan Fly," the photo of John Menhennet's Lockheed S-3A Viking caught my attention. I have a particular affection for this plane, since I worked on it during my time in the U.S. Navy. I'd like to know if this is a kit or if it's scratch-built. Where can I obtain information about it?

TERRY L. JOBE
Tullahoma, TN

Sorry, Terry, John's S-3A was scratch-built using a technique that he and Chris Gold employ on many of their one-off designs. Foam is carved to shape and then covered with a material—in some cases, brown paper. The relatively simple ("squarish") Viking lines would make it ideal for more conventional, built-up balsa, ply and foam fabrication methods. A decent set of three-view drawings would be your first step. As far as I know, there are no commercially available kits for the S-3A. RAU

ELECTRICAL DISCONNECT

In the November '89 issue of *MAN*, there was an article by Ivan C. Meek entitled, "Build An Electric Motor Test Panel, Part 1." The article indicated that Part 2 would be published in the December issue, but it wasn't. It wasn't in the January, February, or March 1990 issues either. Did I miss something? If the Part 2 article was published, can I get a copy of it? I really enjoy *MAN* and hope that you continue to maintain its high quality.

FRANK J. GASPERICH, JR.
Albuquerque, NM

No, Frank, you didn't miss anything. The dozens of others who were waiting for Part 2 didn't miss anything, either. I did. What I missed was the "smarts" to ensure, beforehand, that both parts of the article were "in house" before I committed them to print in two parts. I haven't been

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AIRWAVES

(Continued from page 11)

able to contact the author, so I'm putting together a "Part 2." To you and the other readers who took the time to write, my apologies. I hope you'll find the follow-up material worth the wait. RAU

HUSKY PLATFORM FOR STOL TESTING

Your art director and his staff certainly gave you a wonderful present with the new *MAN* format. Good show!

In the last few years, I've become quite interested in airfoils. I've even read and re-read Abbot's "Theory of Wing Sections" until, with help, I got the gist of it enough to find it useful. An aircraft engineer friend put me on to a new book on wind-tunnel-tested airfoils designed for ultralights. As you probably know, NASA has done very little in the last two decades for general aviation research.

My friend has been thinking about designing and building an ultralight (full scale) using my method of servo-actuated Fowler flaps, and he wants me to build a test model for him. Before I do that, I'd like to test some of the newer, high-lift airfoils with Fowler flaps added. I'd like to build (as a "goat" for wing testing) a model of the Christen Husky, but it appears that Byron has the only one on the market. All I need are the plans, but I haven't seen any. Can you help? It's a pretty recent aircraft, so I doubt if the documentation gurus are into it yet.

CHARLES H. FOWLER
Alameda, CA

Charles, the probable reason that all "the documentation gurus" aren't yet "into" the Christen Husky is that there aren't a lot of them out there and that the airplane really represents a refined version of Piper's popular Super Cub. Unless you're planning to build an exact scale replica for your tests, why not work with one of the many Cub kits presently on the market? Starting with a kit is always easier than starting from scratch anyway, especially when a kit is very close to what you're shooting for. If you plan to build a test bed for wing sections, why go through all the extra work of producing a scale model anyway? If you're set on building a Husky, however, check with Christen Industries, P.O. Box 547, Afton, WY 83110, (307-886-3151). They'd be the best source for drawings, as it's their design. RAU

BUCCANEER FOLLOW-UP

In the March '90 issue of *MAN*, Gord Schindler of West Hill, Ontario, Canada, wanted someone to design plans for a Lake Buccaneer with a 80- to 90-inch wingspan. I just happened to pick up an edition of *Flying Models* (December '71) that had a good Buccaneer article in it. The plans are (or were) available from Model Craftsman Pub. Corp., Reader Service Dept. 1121F, 31 Arch St., Ramsey, NJ 07446 (Plan CF-247). The span was only 58 inches, but I'm sure it could be enlarged. I enjoy *MAN;* keep up the good work.

MONTY STEELE
Winslow, AR

Thanks, Monty. I'm sure that a lot of our Buccaneer fans out there in radio land will appreciate the direction—not to mention Bob Hunt and Frank Fanelli. RAU

"MALDI" MENTIONS MODELS

I'd like to know how one begins to build R/C airplanes. I'd never even

heard of this hobby until I stumbled upon your magazine while on line waiting to buy a lottery ticket.

Can you give me a list of hobby shops in the New York City and Brooklyn area?

DANIEL "MALDI" MALDONADO
Brooklyn, NY

Hey, yo, Maldi, I'm gonna assume that you didn't score big time in the lottery, but I'm glad it provided an opportunity for you to discover MAN. (What exactly do you mean by "stumbled upon"?) Your question is a familiar one and would take an entire issue of MAN to answer, but for starters, your Yellow Pages should give you a pretty good idea of the hobby shops available to you. In addition, the Pennsylvania Avenue R/C Society (PARCS) is one of the oldest and most well-established clubs in your area. They fly regularly at the old Floyd Bennett Naval Air Station, which is now part of the Gateway Park Complex. Check in with them and you'll get some of the best guidance around—and say "hi" to them for me! RAU

In our SWFF coverage (April '90 MAN), I came close to the correct dates for the 1990 Southwest Fan Fly and the Scale Masters finals...close, but no cigar! The SWFF will take place on September 15 and 16 and, if you're like me, you'll hang around to catch the Scale Masters finals on September 20 through 23. For further information on these great events, contact Dawn Buckley (SWFF) at (214) 264-6879, or H. Staats (Scale Masters) at (817) 268-3915 (both in the evenings). RAU

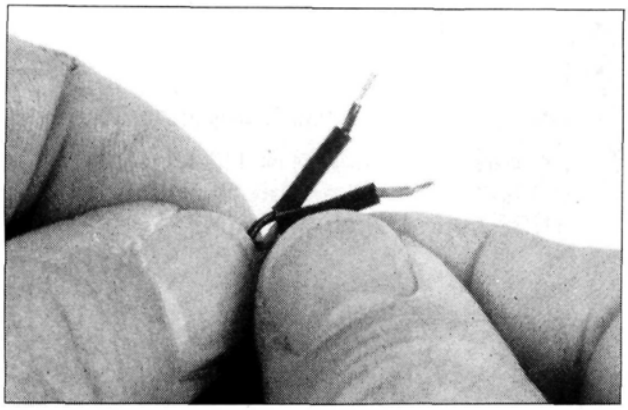
We welcome your comments and suggestions. Letters should be addressed to "Airwaves," **Model Airplane News**, 251 Danbury Road, Wilton, CT 06897. Letters may be edited for clarity and brevity. We regret that, owing to the tremendous numbers of letters we receive, we cannot respond to every one.

HOW TO:

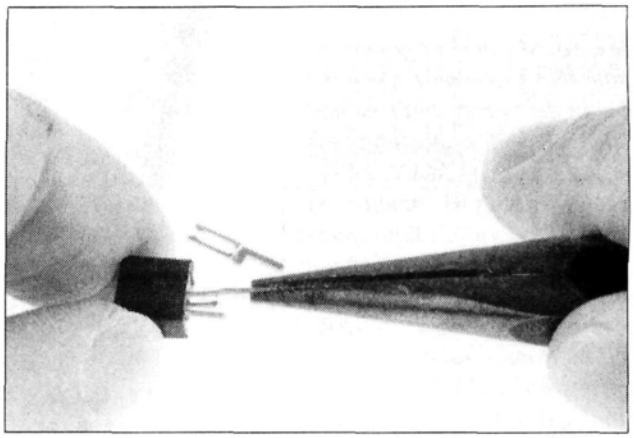
by RANDY RANDOLPH

ASSEMBLE DEANS CONNECTORS

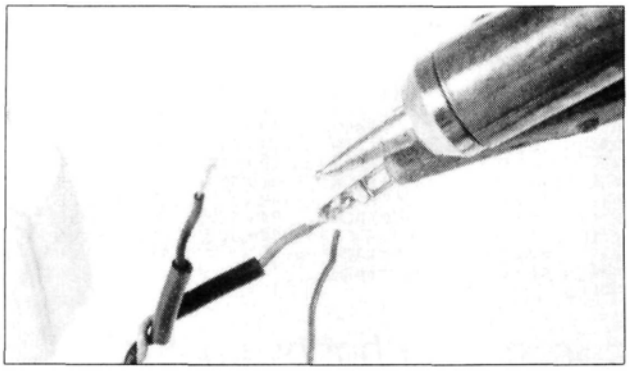
Deans connectors have been around for a long time, and they're some of the most reliable connectors available. The photos show how to assemble these connectors without damaging the plastic parts.



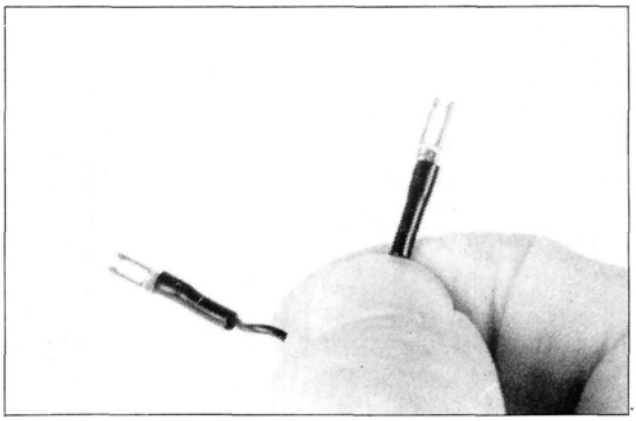
1. *Remove the insulation and tin 1/8 inch of each wire that will be soldered to the connector. Slip the supplied insulating sleeve over each wire. Twist the wires together to form a cable.*



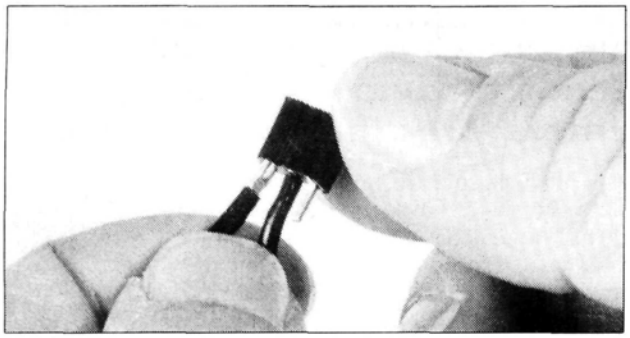
2. *Use a pair of long-nose pliers to remove the gold-plated terminals from the socket. You only need to remove those that will be soldered.*



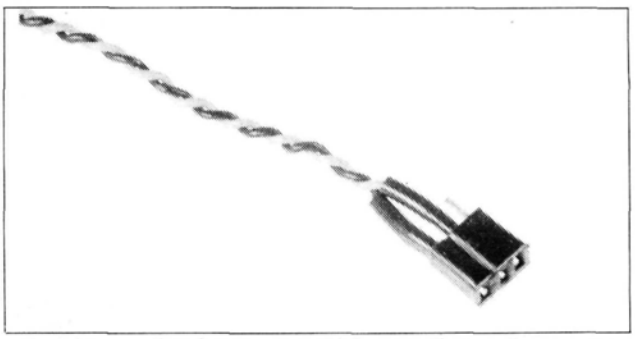
3. *Solder each wire to the TOP of the terminals so that the wire will be centered in the socket when re-assembled. Don't solder the wires to the side of the terminal, or let solder run into the area enclosed by the socket. Use as little solder as necessary.*



4. *After the solder has cooled, slip the insulating sleeves over the terminals. The sleeves should be flush against the stepped portion of the terminals.*



5. *Slip the terminals back into the socket; when they're in the proper place, you'll hear a slight click. Re-assemble the connector in the same way it was removed from the socket.*



6. *The completed connector. Make sure that each connector has been assembled to reflect the polarity of its matching connector.*

PILOT PROJECTS

A LOOK AT WHAT OUR READERS ARE DOING!

$END IN YOUR SNAPSHOT$!

MAN is your magazine and, as always, we encourage reader participation. In "Pilot Projects," we feature pictures from you—our readers. Both color slides and color prints are acceptable.

All photos used in this section will be eligible for a grand prize of $500, to be awarded at the end of 1990. The winner will be chosen from all entries published, so get a photo or two together plus a brief description and send it in !

Send those pictures to: Pilot Projects, Model Airplane News, 251 Danbury Rd., Wilton, CT 06897.

TANTALIZING T-CRAFT

Suffolk, VA, is home for this giant Taylorcraft and its builder, Dennis Vosburgh. The T-Craft's 92-inch span makes it 1/4 scale, and an O.S. 108 makes light work of hauling its 12 pounds around. All the trim was applied using Coverite Presto directly on the Mono-Kote base. Dennis scratch-built the plane from Jim Hiller plans, and he did an outstanding job.

ATTRACTIVE AERO-STAR

Proving beyond a doubt that a well-executed sport model can hold its own in any competition, George Santikian (Fresno, CA) sent us this shot of his prize-winning Midwest Aero-Star, held by his lovely wife, Debi. The model took top honors in the R/C Sport category at the AMA National Fun Fly in Reno, NV. Quality building and finishing make a difference!

SUPER JR. SKY TIGER

James Hammond (Rogersville, AL) didn't include much information with the photo of his Goldberg Jr. Sky Tiger, but we can tell from the photo that he did a nice job on it, especially in the bright, visible color-scheme department. It's difficult to tell the engine type—perhaps an O.S. or Super Tigre—but Jim has apparently fitted the carburetor with an air filter to ensure thatall his flying qualifies as "clean air acts."

WILD WILLIE'S MAD MAX

After seeing "Mad Max Beyond Thunderdome" six months earlier, Willie Gardner (Van Nuys, CA) decided to build his own "sorta-scale" version of the air vehicle seen in the movie. The result is this 8-foot, Super Tigre 2500-powered behemoth. So far, he has logged 38 flights on it and says it "flies great at 25 pounds." Scale aficionados will quickly recognize the full-scale Australian Transavia Air Truck influence, which, not coincidentally, is Willie's next planned project.

SUPERB SUPER STAR

Rege Hall (Dumas, TX) likes things big, as do most Texans we know. So he scratch-built this 84-inch-span Super Star and finished it with MonoKote, except for the cowl and wheel pants where he opted for Cheveron paint. The attractive scheme duplicates that of the Super Star flown by Henry Haigh in previous World Aerobatic Championships. A Webra supplies both the power for the airplane and the heat source for the smoke system. At 14 1/2 pounds, Rege's model is sure to have prototypical performance.

"SETTLE" FOR A SCRATCH-BUILT SKYHAWK?

Mike Cramer (Mountville, PA) says that he'd like to get into ducted fans, but the size of his club's grass field makes him "settle" for his scratch-built, prop-driven A-4 Skyhawk. Mike drew his own plans for the 49-inch-span "jet," choosing an O.S. .46 for propulsion and MonoKote for covering. He says it flies well and, if looks are any indication, we can see why. We'll "settle" for this pretty model anytime!

CANADIAN DEFENDER

Would you believe that underneath this camo-clad, rocket-pod-totin' MD-500 Defender body lurks a friendly Hirobo Shuttle?—and a Mk. I at that? Gary Vilette (Kitchener, Ontario, Canada) scratch-built the body from fiberglass and balsa; he claims that the increase in weight over the stock body produces a better hover and more scale-like vertical performance. Power is provided by an O.S. .28H—looks functional!

SCHIZOID EAGLE

Looking as though it doesn't know which way is up—or confident that it can land either way!—is the Christen Eagle built by Bob Bellino (Florence, CO) from the Pilot kit. With a span just short of 50 inches, the Eagle is powered by an O.S. .61 FSR that's equipped with a very obvious Macs tuned pipe. A Futaba radio provides the guidance for this MonoKote- and Formula U-finished beauty. Craig Hosking has a full-scale Pitts rigged the same way for airshow work. Better you than me!

FIFTY YEARS AGO

UMBRELLAS THAT FLEW AND WW II STEW?

by KATHERINE TOLLIVER

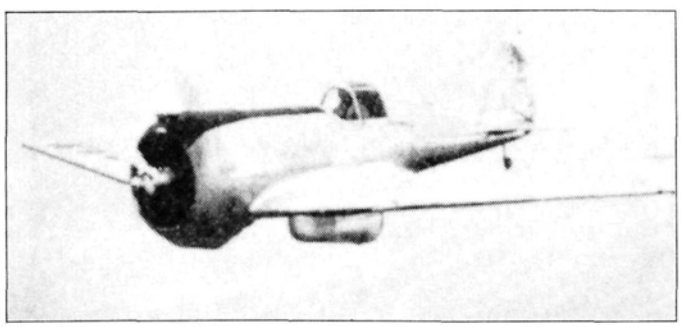
A SURPRISED group of spectators at Ohio's Wright Field witnessed test pilot Maj. Stanley Umstead "float" to earth in a Ryan YO-51, otherwise known as the "Flying Umbrella." *MAN* reported that the Air Corps' latest observation plane featured a fully slotted wing with an extended trailing-edge flap that increased the airfoil curvature and the plane's lift. The Ryan, which could take off in a steep climb and land nearly vertically with little landing roll "settled slower than a parachute."

Modelers intrigued by the sight of a plane making a gentle landing, could make a parachute out of tissue or silk and attach it to their models. Experimentation was encouraged: "Wrap the chute around a rock and hurl it into the air." What do you do if you hurl your chute into hostile territory, e.g., the neighbor's living-room window? You read the article entitled, "Your Model and the Law," which discussed the legal ramifications of model aviation.

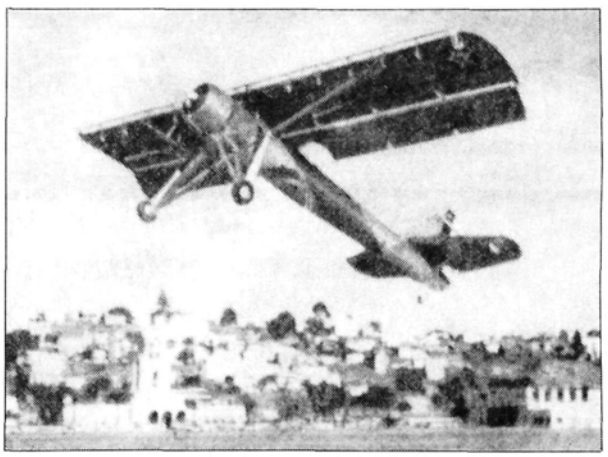
EYES IN THE SKY

Observation planes were more than flying umbrellas. The June '40 issue included a discussion of the history of U.S. Observation aircraft, and one of the 16 photos that showed its development was the ship that pioneered the way in the '20s—the DH-4. Advances in the plane's design were hampered when the Army stipulated that surplus WW I Liberty engines were to be used before the more powerful, liquid-cooled engines could take their place.

The June cover featured the Curtiss XS3C-1 Scout Observation plane—a two-seater, mid-wing monoplane powered by a Ranger SGV-770B 12-C. This was the first time the Ranger engine had been used by the Navy and the first time a vee engine had been installed in a Navy plane.



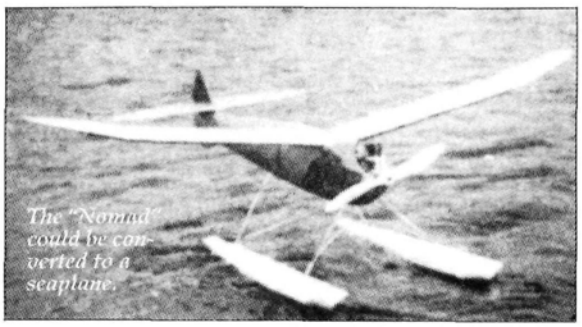
The Curtiss CW-21's four machine guns were synchronized to fire through its propeller disc.



The Ryan YO-51 (or Flying Umbrella) had a high wing and large flap area.

With a wingspan of 39 feet, 8½ inches, its top speed was 190 at 11,500 feet. The seaplane gear was a full cantilever design, and full cantilever wing pontoons were bolted into the wing panel outboards near the tops.

You could build your own double-duty gas model called the "Nomad" that could be easily converted to a seaplane. To increase speed and to keep a very high angle of climb, the wing was placed directly at the top of the fuselage instead of above the fuse, and a Grant X airfoil was used.



The "Nomad" could be converted to a seaplane.

STEW à la *MAN*

Yes, there really was a recipe for "stew," and it appeared in the "Frontiers" column: add a "dash of Curtiss" (use the CW-21 that climbs over 5,000 feet per minute with 1,000hp), some Douglas bombers (the fast, light variety), and to really spice things up, throw in some Lockheed bombers. *MAN* cooked up some interesting articles for June 1940. ■

AN ELECTRIC-POWERED BLEND OF GOOD LOOKS AND PERFORMANCE

by HAL deBOLT

THERE ARE ALREADY many excellent model designs, and it's difficult to improve on them. When I decided I wanted a high-performance electric-powered airplane that would fit the AMA endurance category, it was obvious that any refinements would be subtle. With the Javelin, however, I do show that there are still new things to be tried and improvements to be made in the pursuit of better performance. Let's look at the Javelin's design features:

WING DESIGN—THE KEY

The wing is of paramount importance to any electric-powered (EP) endurance flight. Two qualities are both desirable and achievable:

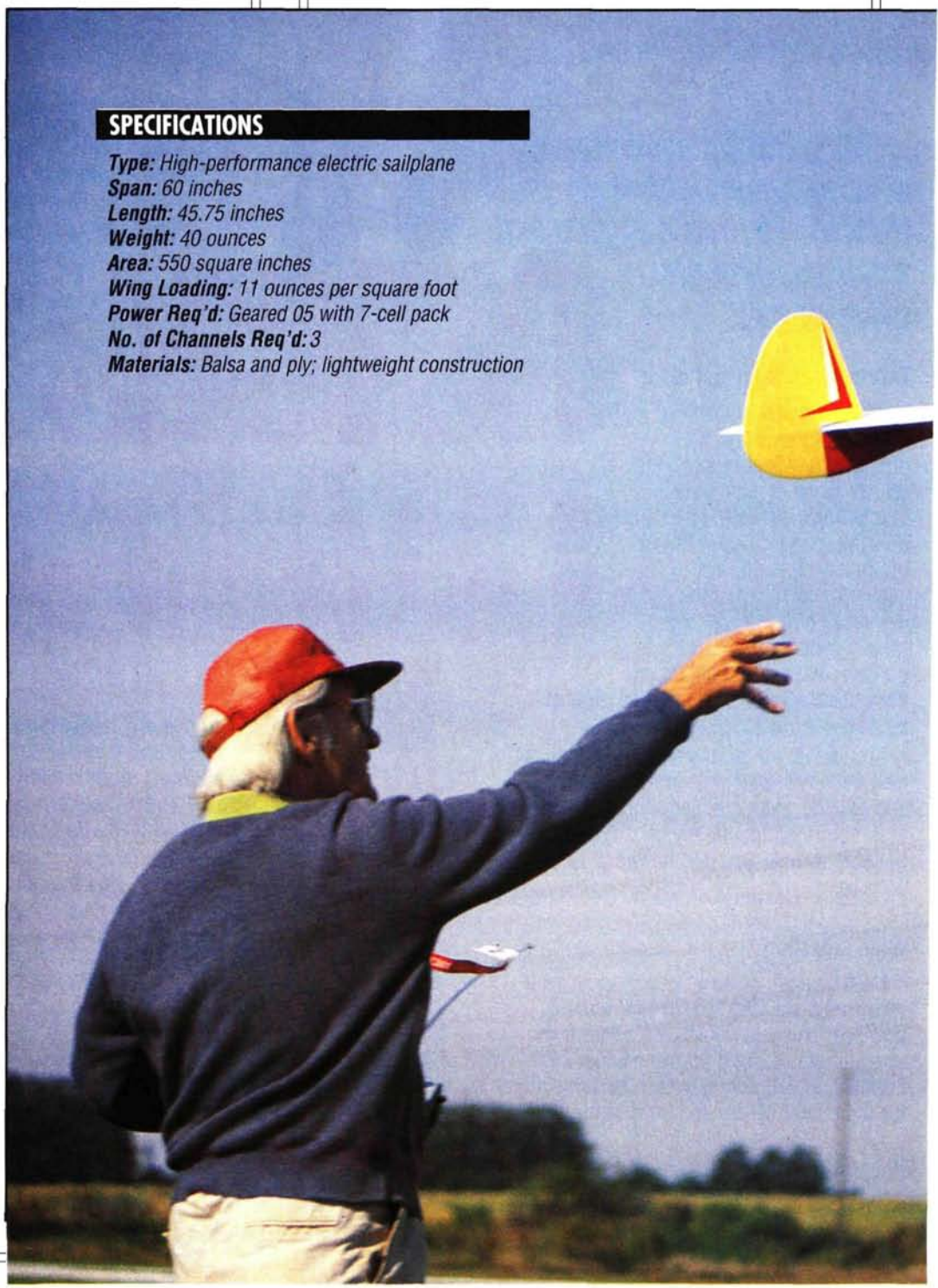
- The plane should have low drag and be stable enough to allow the available power to get the plane to thermal altitude quickly.
- At altitude, it should have a low sink rate and good response to lift.

Looking for an airfoil that has the necessary low drag and still provides good lift is like asking for a simultaneous night and day! Davis foils are noted for their excellent lift, but the undercamber of the more well-known versions can cause more drag than one would like. Luckily, I found a relatively unknown flat-bottom Davis foil in John Malkins' comprehensive "Airfoil Sections" book. About the same thickness as an Eppler 205, the laminar characteristics of the Davis should reduce drag.

We see high-performance R/C gliders (using ailerons) flying very impressively with practically no dihedral. We also know that there should be *some* dihedral effect if the rudder is to be useable for turning. For reasons of simplicity and weight, I decided this design would use rudder control, but no ailerons.

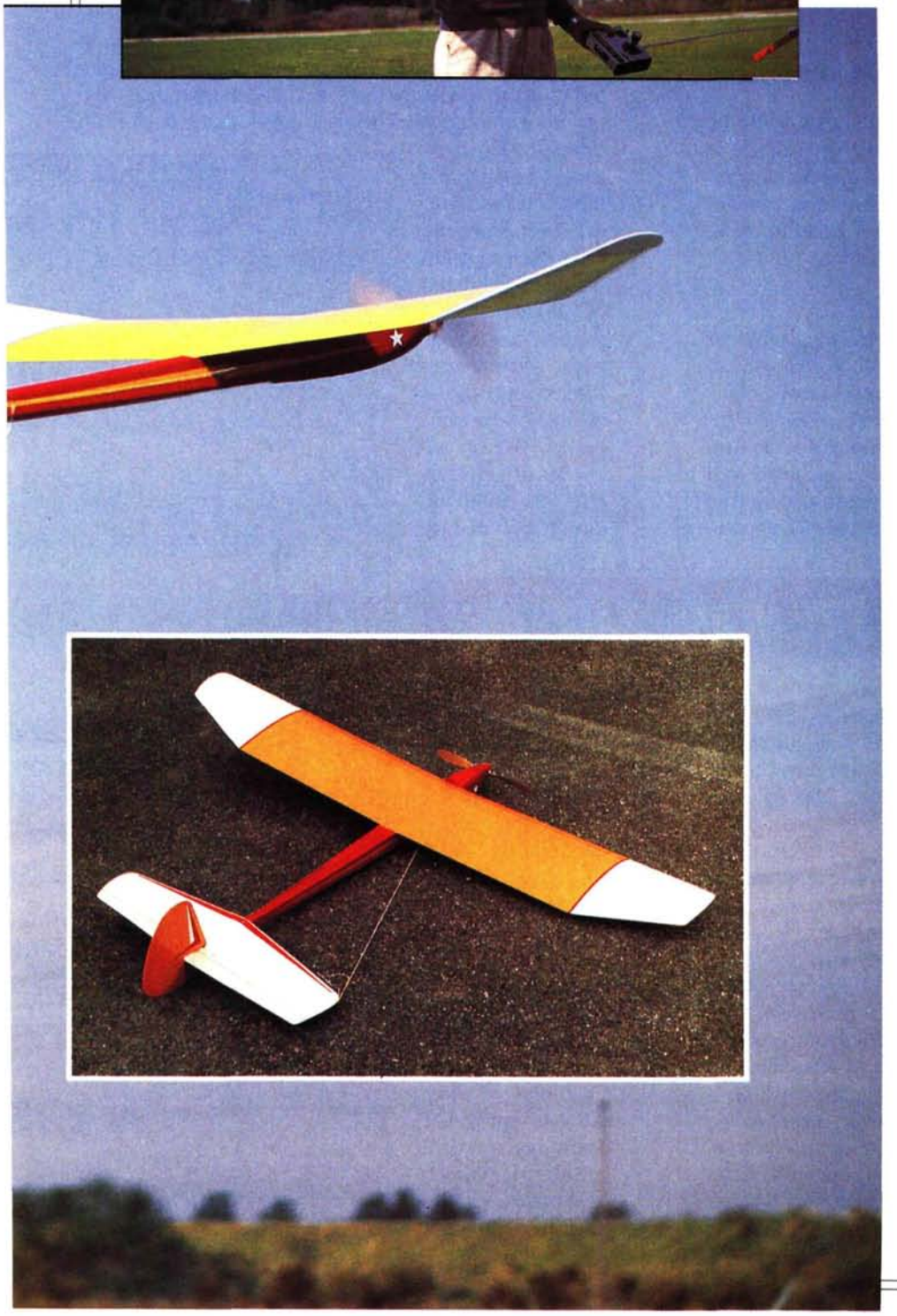
SPECIFICATIONS

Type: *High-performance electric sailplane*
Span: *60 inches*
Length: *45.75 inches*
Weight: *40 ounces*
Area: *550 square inches*
Wing Loading: *11 ounces per square foot*
Power Req'd: *Geared 05 with 7-cell pack*
No. of Channels Req'd: *3*
Materials: *Balsa and ply; lightweight construction*



THE JAVELIN

PHOTOS BY HAL deBOLT



#6901 THE JAVELIN $8.50

Hal "Pappy" deBolt has taken up electrics in a big way: he's designed a high-performance, powered sailplane that's equally comfortable with a variety of 05-size electric motors. With an all-up weight of only 40 ounces, the Javelin's 5-foot-span wing allows the flier to "power up" to altitude, shut the motor down and go thermalling. The design incorporates many proven free-flight techniques along with refinements that improve performance. Lightweight, conventional materials and construction techniques make it suitable for novices to intermediate modelers. Three channels required. Large single sheet plan.

For turning, the dihedral effect increases toward the wing tips. With this in mind, the center two-thirds of this wing has only minimum dihedral, and the polyhedral tips add a little more. At first glance, this arrangement seems unusual—even scary—yet I had to try it. In all respects, it has been proven adequate.

POWER CONTROL

To help with power control, I use a horizontal stabilizer with 25 percent area and a lifting airfoil. With some tail lift, the CG can be further aft; for power control, tail lift will increase with speed, so helping to compensate for the additional wing lift the increase in speed generates. In practice, this air-speed control proved adequate with normal power, but later tests with greatly increased power required the addition of the downthrust shown.

ORDER THE FULL SIZE PLAN...PAGE 108

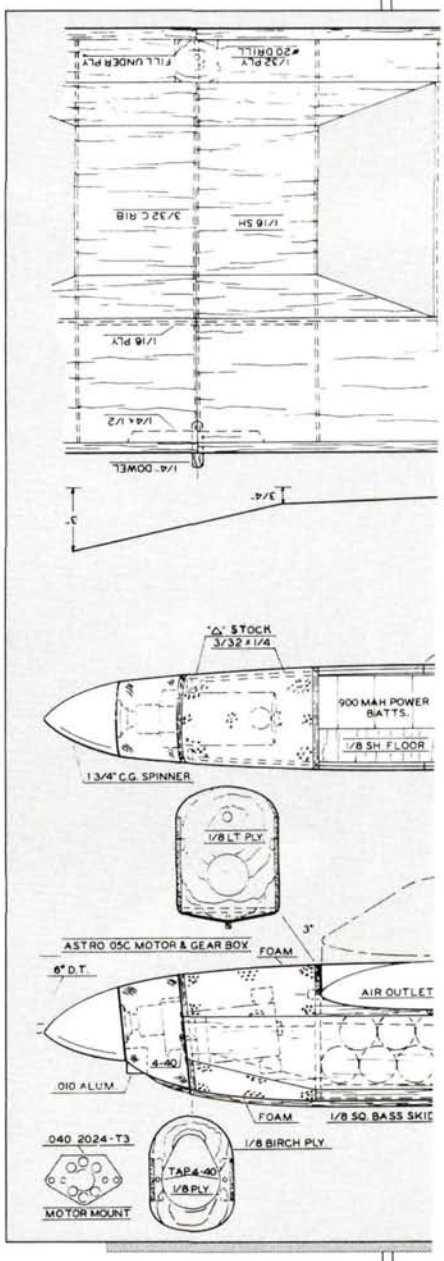
Obviously, I must do more work with aerodynamics and force arrangements when max power is available so that I can eliminate the need for power-wasting downthrust.

The vertical tail is all moving rudder. This solves a problem seen with other gliders and electric-powereds: soft rudder reaction, especially in the glide mode. I also hoped it would be good insurance for adequate rudder control with the desired minimum dihedral.

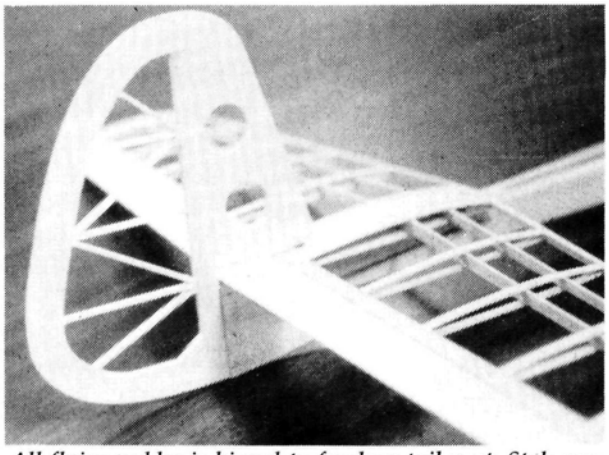
There's a sub-fin that serves two purposes. With free flight, we learned to keep the aft lateral area low to enhance spiralling stability; the sub-fin effectively lowers the amount of vertical tail area that's necessary. One plane neatly demonstrates this effect: the prototype Live Wire Jenny had no sub-fin and showed a tendency to progress from a normal to a flat spin from which it wouldn't recover. Considerable area was added to the normal fin, but to no avail. With the original fin, however, just the addition of a small sub-fin made spin recovery excellent. The proof of the effect of a smaller lateral area was dramatic! So, while the Javelin sub-fin is aerodynamic, it also provides the length of hinge needed to make the all-flying rudder practical.

Flight evaluation of this style of rudder was very satisfying; it worked as hoped! With normal rudder movement, the very first rudder correction yawed the Javelin nearly 90 degrees (totally unexpected!); and careful use of rudder brought it down safely. With rudder movement reduced by 50 percent, the next flight was delightful. Response under power was definite, and reaction in the glide was both instantaneous and positive. (Perhaps the designers of the WW I Nieuports and Fokkers knew what they were doing!)

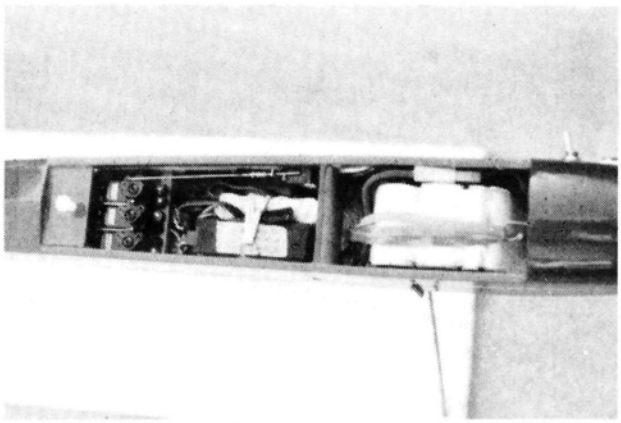
The appearance of the Javelin's force arrangement can be deceiving. (The *seemingly* short nose and long tail moment made me think of a javelin and that's the origin of the name.) The short nose also comes from my past FF experience. Consider that there's a mechanical lever from the CG to the propeller. At the forward end of this lever, there's weight (motor, etc.) plus gyroscopic forces and thrust created by the propeller. What we know of physics tells us that the closer such disruptive forces are to the pivot point—or, in this case, the CG—the greater will be their effect on stability. With FF, really controllable power didn't come until the propeller was moved back as close to the CG as practical. (Shulman's Wedgy and the Zipper are examples of this; we can apply OT learnings to modern electric power!)



Actually, the Javelin's tail-mo-

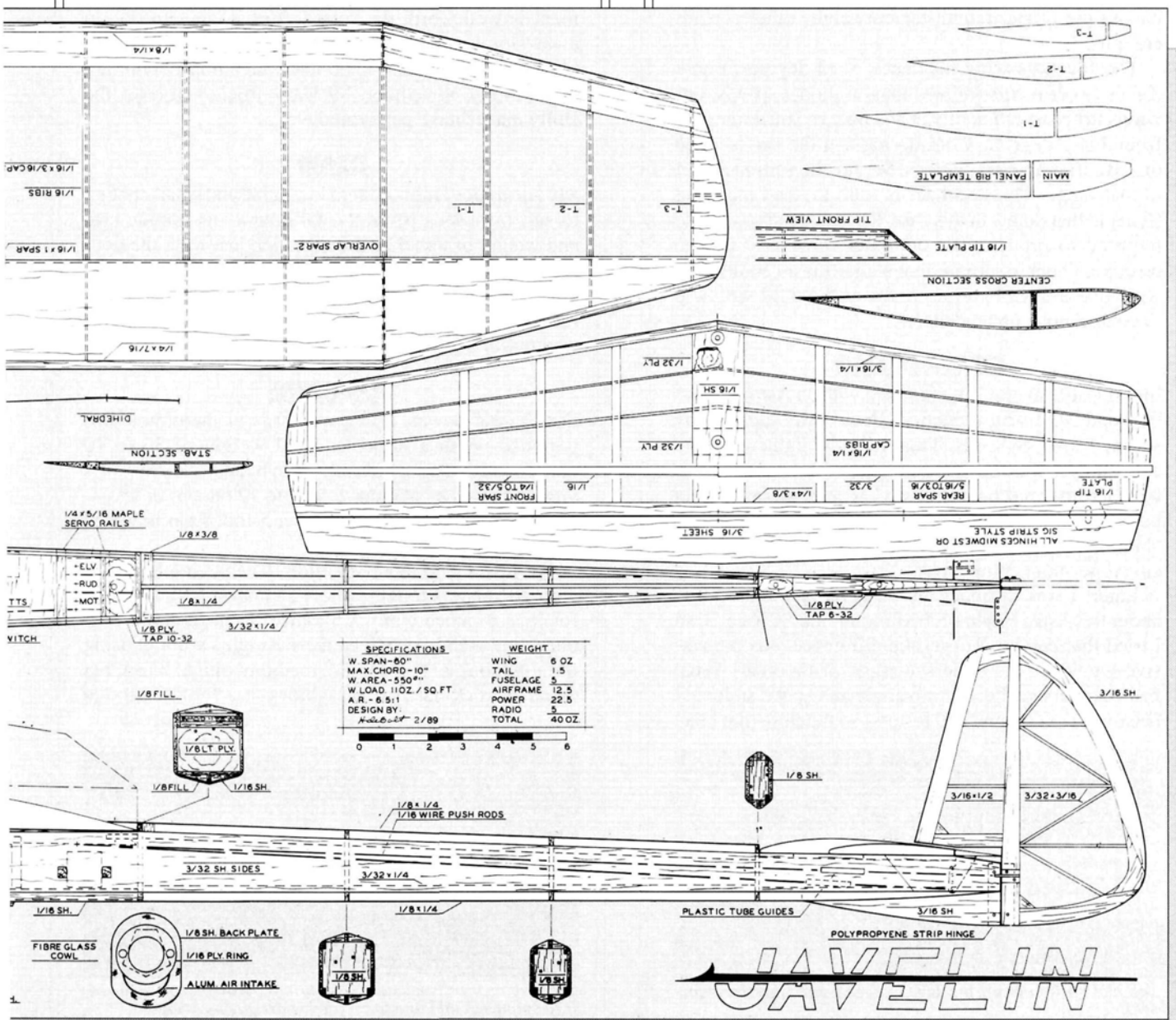


All flying rudder is hinged to fuselage tail post. Stab uses capstrip ribs for simplicity and lightness.



Equipment (left to right): servos, receiver/battery/motor switch, power battery. Airtronics mini-system fits easily; normal size system will also fit.

ment arm is normal at 43 percent. As you can imagine, it's the rear location of the rudder that makes it look excessive. Of course, the rudder moment is longer, but that only enhances the desired reaction. A long tail moment and a short nose moment can create balance problems, but with the EP ballast available and careful attention to tail-weight reduction, the combo becomes practical for this EP design. Aerodynamics tells us we shouldn't



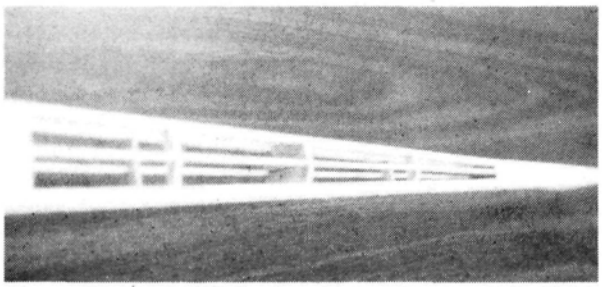
cheat with tail moments; the pitch stability gained from having the proper length far outweighs other considerations.

The Javelin's wing incidence is +3 degrees. Frank Zaic's experiments showed that, at model speeds, our wings lift most efficiently at an angle of attack ranging from 5 to 7 degrees. Considering that the Davis angle of zero lift is about 3 degrees, the Javelin setting puts it in that range. The stabilizer is used to keep the wing flying in that range. In this case, the stab incidence angle required to produce the optimum force is 1 degree positive. Other assets are that stab lift is an addition to wing lift, and with power on, the positive lift will help to control nose-up tendencies.

POWER SUPPLY

Initially, the Javelin was equipped with an Astro Flight* 05C and 2.2:1 gear reduction. Power was supplied by seven, 1.2Ah, SC cells. Tests with the lighter 800 SC cells showed little change, and this power was adequate to reach thermal height easily, where soaring could begin. At altitude, there's enough reserve power to go "hunting," or to ascend at will (a very satisfying flight envelope—and competitive).

Later, I was intrigued by observations and reports about the Astro Flight 05 FAI motor and SCR cells, so I tried that combo. To say the difference was impressive would be the understatement of the year! What had been an excellent climb angle and speed suddenly became *much* steeper and faster—so much so that I had to resort to downthrust to keep the angle off the vertical! So, if you use the high power, you'll need the downthrust; with less power, you needn't use it.



Top and bottom of aft fuselage is open framework for lightness.

PROPER PROPPING

In the past, I've raved about the importance of having the proper prop/power supply combo. Considering stock propellers, sizes in the 12Dx8 to 10P have proven satisfactory with both power levels. The difference is higher rpm with the FAI setup. Considerable gain is seen with prop rework, however. The improvement is well worth the small effort it takes to do; an even simpler method may be the use of Bolly* EP blades: 13x7 folders. (The necessary hub details are given in my November '89 *MAN* article.) In tests, the Bolly blades have performed well.

RADIO

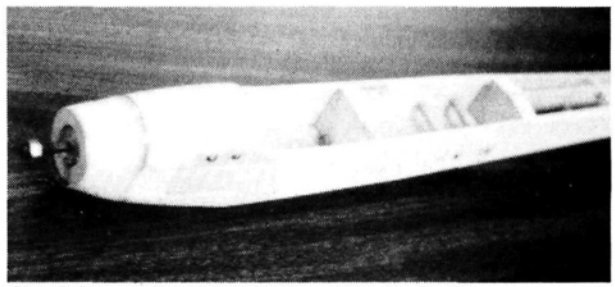
My Airtronics* mini-system is reliable and small enough to suit my needs perfectly. Of course, its minute size and weight of less than 5 ounces are just what the doctor ordered for EP designs. The mini-servos provide ample power while maintaining excellent resolution; rudder and elevator are used, and there's a servo-operated motor switch. Simplicity!

STRUCTURE

For electric power, flying weight is of the utmost importance. With a projected total weight of 36 to 40 ounces (considering differences in battery weights), it's vital to keep the airframe weight to 12 ounces or less—a considerable achievement for a 5-foot-span powered model!

For this, I paid close attention to achieving lightness with adequate strength. The 12 ounces are accounted for by a 6-ounce wing, a 5-ounce fuselage and a 1 1/2-ounce tail—and I achieved these weights without using ultralight balsa. You can use medium-weight balsa, but avoid the rock-hard stuff! Lightness is achieved through

(Continued on page 70)

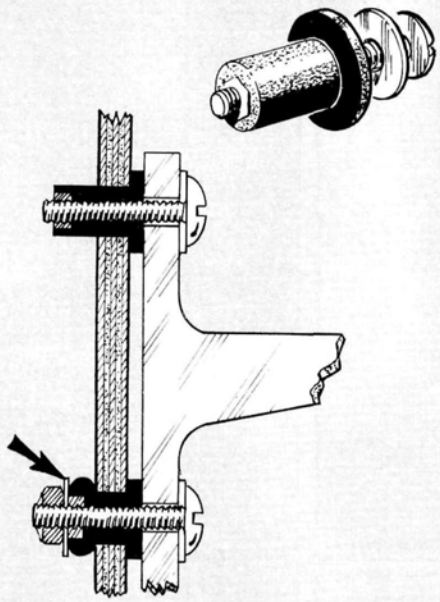


Simple box-style fuselage is streamlined, with foam nose faired into spinner. Cowl and foam fairing are glass-covered.

HINTS & KINKS

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send a rough sketch to Jim Newman, c/o **Model Airplane News,** 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material. Tips without names and addresses are reprints from previous issues.

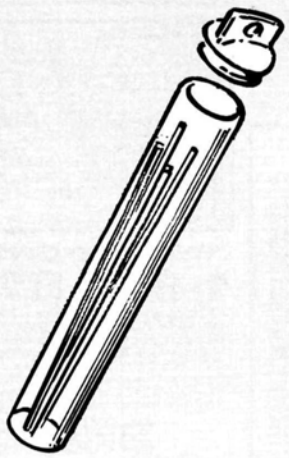
by JIM NEWMAN



KILL BAD VIBES

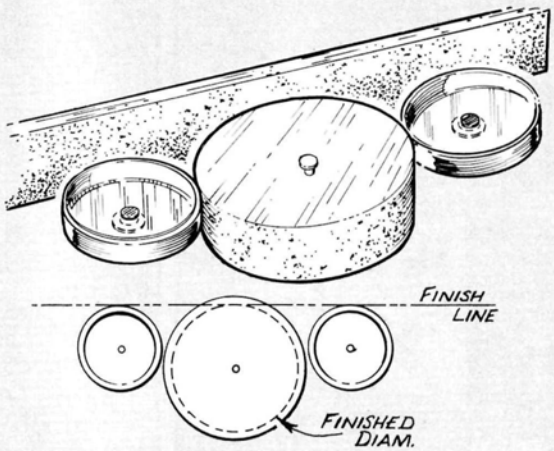
Rubber well-nuts (available from auto-parts and hardware stores) provide an inexpensive way to isolate your airframe from engine/propeller vibration. Tighten the screw, and the rubber will expand behind the firewall to retain the mount and seal the holes. They're tough enough to hold roof racks, but because of the presence of oil, I strongly recommend that you use the extra washer and epoxied nut (arrowed) as a safety measure.

Robert Bubello, Meriden, CT



STORAGE TUBES

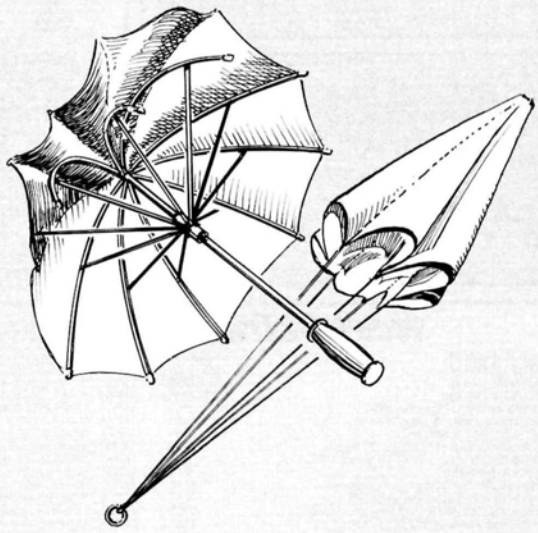
Windshield-wiper blades are sold in plastic display tubes with tabbed plugs. These are useful for storing pieces of metal tube and short lengths of wire. The tubes are 3/4 inch in diameter and up to 18 inches long, but two can be joined to suit longer stock.



WHEEL-TRUING JIG

If you replicate vintage wooden wheels, try this jig that's made from a piece of board, two 35mm film-canister lids and a sandpaper-covered yardstick. The lids rotate on a small nail and are supported on a washer. Pin the wheel blank between them, and sand away until the sander is running on the rotating lids. A perfect wheel blank every time!

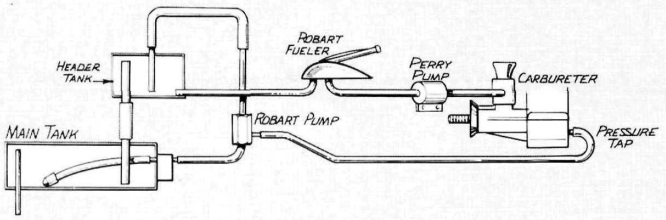
Eric Marsden, Horndean, Hampshire, England



READY-MADE PARACHUTE

Look for old sun umbrellas at yard sales. Stripped from the framework and fitted out with rigging lines, these multi-colored parachutes are ideal for air-show drops. Don't seal the vent hole in the top—it stabilizes the 'chute.

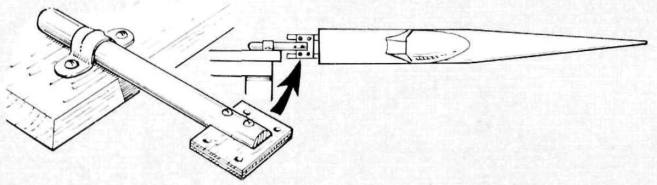
Kjell Risholm, Breim, Norway



REMOTE MAIN TANK

The inverted engine in a large-scale Fieseler Storch means an extremely low spray bar, and a quart tank at that level is out of the question. The answer? A small header fed from a remote main tank. To avoid pressure build-up, the header overflow line is twice the size of others, and both tanks are fueled and de-fueled through a Robart Fueler, which also acts as a fluid "kill switch" for the 5.8hp engine by shutting off the fuel when actuated.

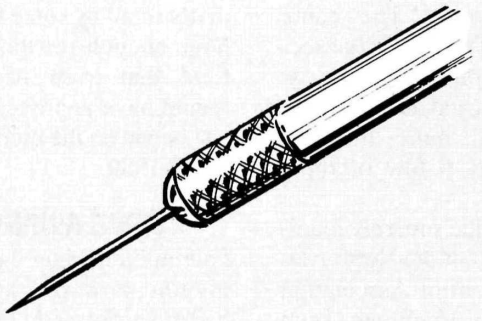
J. Lebeau, Diegem, Belgium



PAINTING AND COVERING JIG

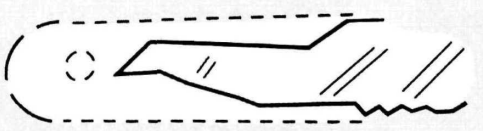
A piece of broom handle, 1/4-inch plywood, a conduit clamp and a few screws create this "third hand." Bolted to your engine mount and screwed to a bench, it allows the fuselage to be rotated for painting and covering. It will work for a bolt-on wing, too.

Charles H. Brown, Jackson, MS



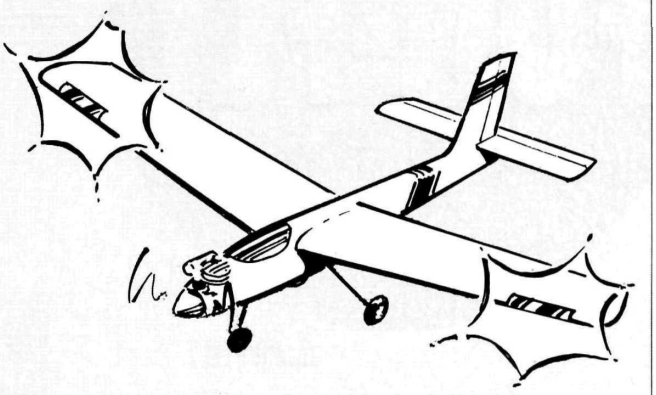
PICK UP OR PERFORATE

A regular "T" pin inserted into a no. 4 or 5 X-Acto handle works well for picking up small pieces or perforating balsa before covering with film.



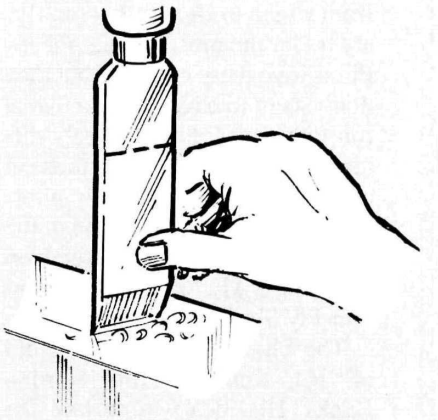
BALSA PICKER

Grind a hacksaw blade to make a balsa picker for hinge slots. Your Dremel grinder will do a good job, but wear safety goggles! The opposite end can also be ground to fit a modeling-knife handle.



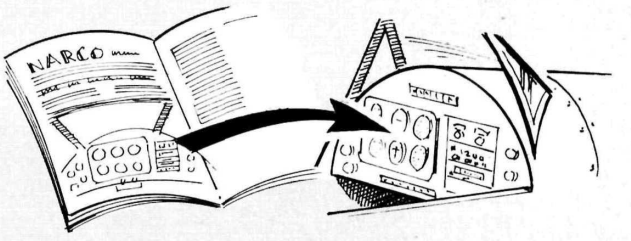
SIMULATE STROBES

A 2x1-inch piece of chrome Mylar tape on each wing reflects strobe-like flashes that are a real attention-getter! Why not put one on the fin—red, perhaps?



CHISEL AWAY!

While scraping epoxy, single-edge razor blades can chatter or snap. A really sharp 1 1/2-inch wood chisel is rigid and makes a superior tool for this job. If the chisel itself is no longer required, it can be cut at the dotted line. You might also investigate a replacement smoothing-plane blade, as we did.



REAL INSTRUMENT PANELS

Check flying magazines for glossy ads that show instrument panels. Clip and glue them into your latest model; if it has an open cockpit, add a coat of fuelproofer. Decorate them with a few knobs and switches, and you have a convincing panel!

Wayne Lehman, Lancaster, PA

R C R FUN-FLY SHOOTOUT

by MIKE LEE

And you thought fun fly meant fly what you have handy!

PHOTOS BY MIKE LEE

The Florio Flyer crowd. These 11 guys brought 20 birds and lots of guts to place high against the specialty aircraft. A fun-loving group headed by Jim Florio, all are great pilots.

SCALE, PATTERN, PYLON and sailplane—take your pick! Model aircraft pilots have a variety of competitions from which to choose, but fun flys are by far the most popular meets. Pilots love these contests, but they don't seem to have realized that at fun flys, you find an entirely different breed of pilot from those at other competitions. Fun-fly pilots are highly skilled, and some of the best in the nation converged on Huntsville, AL, for the R/C Report Fun-Fly Shootout.

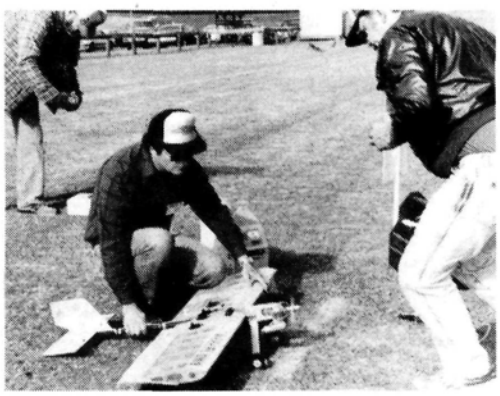
The Shootout is the brainchild of "R/C Report" Editor Gordon Banks. His idea was to lure the best fun fliers to an all-out competition that would not only give them bragging rights, but would also bring them unusually high rewards. Gordon's bait was over $11,000 in merchandise, which would be awarded to the top 25 pilots, and it worked! They came from all over! The event (the second) attracted pilots from as far north as Canada and as far west as California, and more than 53 signed in—only a few of them locals.

The site was the superbly manicured grass field of the North Alabama Radio Control Association (NARCA). Only 15 minutes from the host motel, the runway was 350 feet long and 65 feet wide; that's small by some standards, but large enough for this event. On a field that even Arnold Palmer would have approved of, the contest began on the morning of October 7, 1989.

RUDE AWAKENING

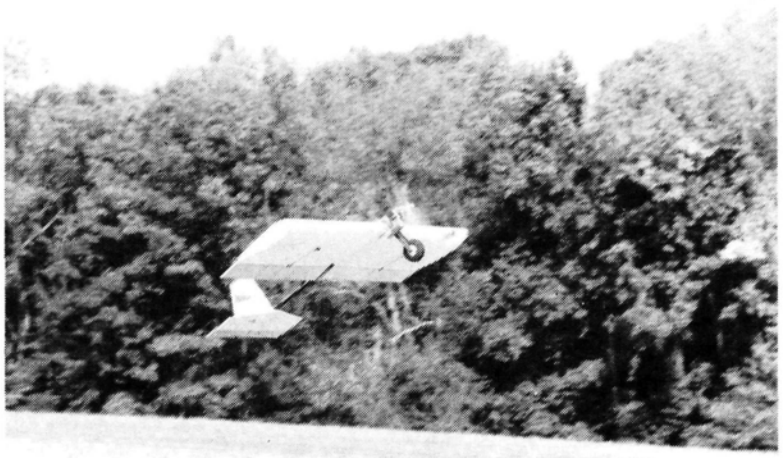
I admit I felt smug: I planned to fly my tiny, powerful, agile Hots II. I had practiced, and I figured that my chance of coming out near the top

David Nixon runs his bird for sound testing before his flight. To keep the neighbors happy, a strict noise rule was enforced.



Bill Wachtler fires-up his Yard Stik fun-fly bird for an official flight. His specialty bird had its servos completely exposed (outside the ship).

Jerry Smith gives the thumbs-up sign as he celebrates his 1st place. He carted off his spoils in this wheelbarrow.



A Stik-style bird is off the deck. Note the up-elevator and lowered flaps ready for low-level, extremely tight loops.

was pretty good, but my euphoria lasted only until I saw what I was up against.

The first group I saw flying was the wild and crazy Florio Flyers Team from the upper Eastern Seaboard: 11 pilots from Connecticut, Canada and other cold places whipped out their potent, high-powered Florio aircraft and tore up the sky during practice day. Was I demoralized? You bet!—but I optimistically thought I could take out a few of them and still finish respectably. Then the *real* eye-opening act appeared!

On the grass nearby, I saw some of the strangest—even ugliest!—fun-fly aircraft. They were large (most had between 600 and 725 square inches of wing); they were thick (their wing-chord thicknesses ranged from 20 percent to 35 percent); they were extremely light (a couple weighed less than 3 pounds, wet!); and they had huge flying surfaces that allowed incredible maneuvering. Most of these birds were powered by engines of less than .32 size. My mood had changed!

20-SECOND CIRCUIT

First, the pilots were told the rules, and their aircraft were thoroughly safety-checked by members of the host club. The first event was to be "Modified Dixie Death"—strange name for an event, but what the heck! For this, we had to take off at the drop of a flag, perform three loops, three rolls, a touch-and-go, three more loops, rolls and then land. Hmmm, no sweat; during my practice flights, I had that down to less than 1 min-

Jim Gianico of Greenville, SC, brought this example of a purebred fun-fly bird he calls the "Midwing." It's typical of these incredibly maneuverable birds, which make everything else obsolete. Note the huge ailerons, rudder and elevator. A Webra .28 provides power.

Watched by her husband, Gayla McGee gets off the deck. She showed quite a few pilots how the events should be flown.

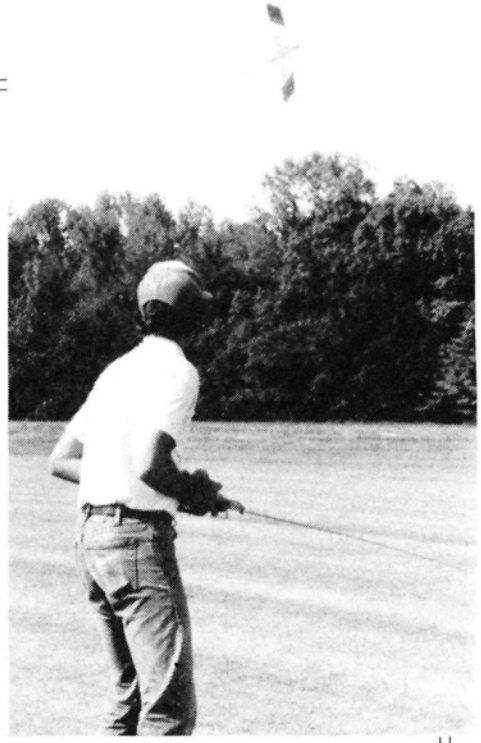
R C R

FUN-FLY SHOOTOUT

FINAL STANDINGS

1st—Jerry Smith	5th—Ken Jackson
2nd—Harold Parker	6th—David Rice
3rd—Mac Hodges	7th—David Grantham
4th—James Barr	8th—Kevin Siemonsen

John Maloney Sportsmanship Award—Bob Hasting



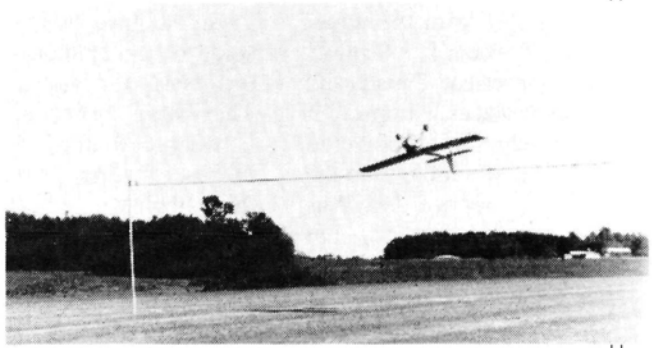
Right: Masters Class pilot David Von Linsowe's bird comes hard about in the midst of a competition flight. Definitely the quietest bird, it could also dice it up with the specialty planes.

ute, but as it turned out, my 1 minute was one of the longest times in this event. The strange aircraft I had seen (most commonly called "Yard Darts" or "Stick-Its") performed the Dixie Death in a mere 20 seconds!

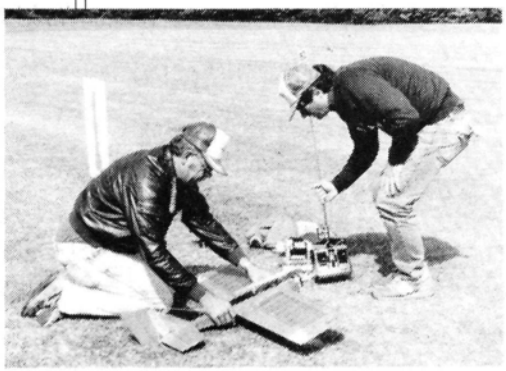
It was amazing! Their pilots were able to get the Sticks to lift off the runway in less than 1 foot, loop within only 3 feet, roll so fast that three rolls were almost impossible to count (so most did five or six!), and then return to the runway after traveling only a fraction of its length. They immediately made every conventional aircraft obsolete for this competition. Mac Hodges won the event with Jerry Smith right behind him, and he was followed by a bunch of the other "stick" birds and a sprinkling of conventional birds with decent times.

In the second event, the task was simply to perform 10 touch-and-go's on the runway as quickly as possible. Most of us were content to bring our birds back to the runway within 10 seconds of each touch, but the special stick birds were able to make the cycle in only 3 seconds! Try that with a production aircraft and you'll be buying another airplane really quickly. This time, Jerry Smith managed the top spot, again with a time of around 20 seconds; Harold Parker came in 2nd and David Rice in 3rd.

Left: Don Nichting shows the way through the Inverted Limbo Pass. This was one gutsy event; only a few pilots were able to "thread the needle" on all three attempts. Many plowed their birds!



Right: A near miss for the Inverted Limbo Pass. Kevin Siemonsen was the pilot of this Florio bird.

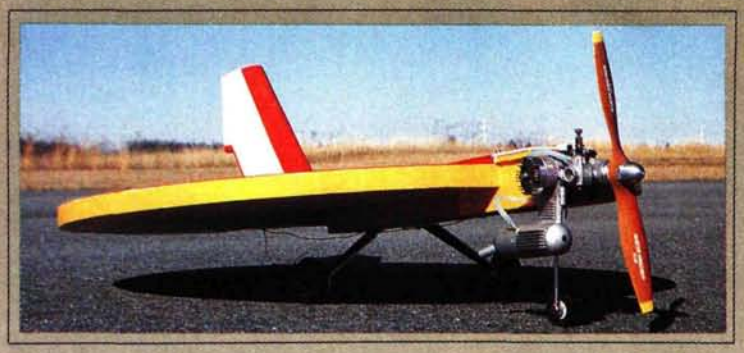


A converted control-line Flite Streak was about as close as any kit could come to matching the specialty birds. Look at that rudder! (Pilot is unknown.)

BIG FOAM TARGET

The schedule of events was modified to cope with the unexpectedly high number of registered fliers. By 4:30 p.m., it was decided to drop Standard Limbo and instead, we were treated to demo flights and given a chance to show our skills at plane thrashing. Duracraft's Jeff Prince brought three of his famous Duraplanes, and the target for the pilots was a 4x8-foot sheet of 1/2-inch-thick foam, which was propped up in the middle of the runway. For each pass you made, you paid the club $1—*unless* you hit the target! I missed four times before giving up, but between them, the Florio Flyers hit the target four times. This was a great run, courtesy of Duracraft.

(Continued on page 103)



BONDED MODEL PRODUCTS ROUN' TUIT

by RALPH CLOUD

IF YOU'VE EVER worked in an office, you've probably seen those funny drawings or stories that find their way into so many in-baskets. Many years ago, when I reported for work at a new job, one of these drawings was under the glass desktop. It consisted of the word "Tuit" in the middle of a circle; underneath the circle, it said, "This is an indispensable item! For years, people have been saying, 'I'll do it as soon as I get around to it,' and now you can!" We've included a "Roun' Tuit" in the layout; cut it out, keep it handy and you'll never have trouble getting everything done, because you finally got a Roun' Tuit.

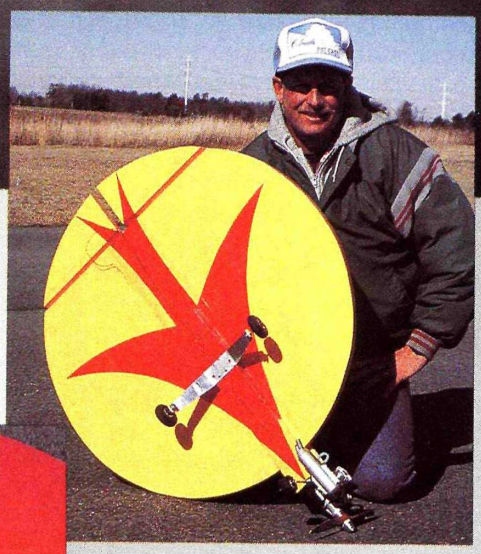
Several months ago, Editor Rich Uravitch and I talked about doing a Field & Bench Review, and I mentioned that I wanted to do something unusual. Well, unusual is what I wanted; unusual is what I got. He gave me a Roun' Tuit from Bonded Model Products*. Whenever he asked me when the project would be finished, I wasn't able to make any excuses. I couldn't say, "As soon as I get around to it," because I *had* a Roun' Tuit!

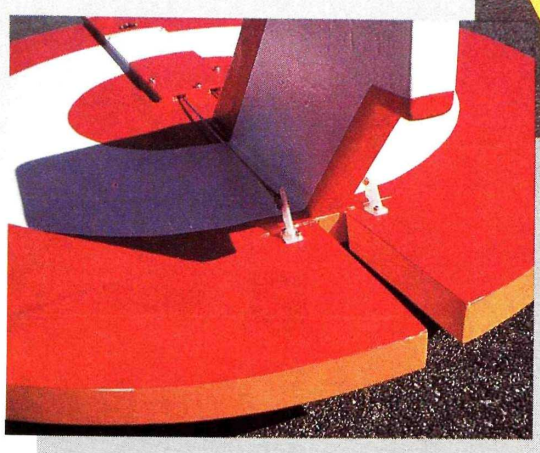
LET'S GET TUIT

Although the Tuit design is very basic, the people at Bonded Model Products told me that a lot of research went into the final design. They

ving pizza, or airborne target—an imaginative and simple approach to fun flying!

KODACHROMES BY RICH URAVITCH



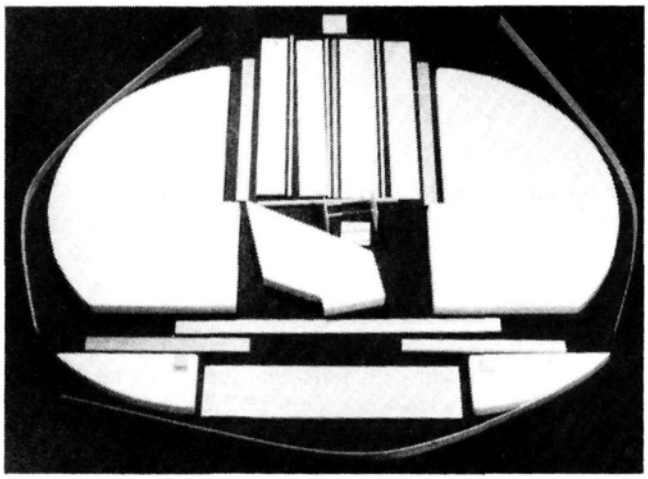


Above: It appears that Ralph finally got a Roun' Tuit.
Left: Only movable control surface on the Tuit; maybe they should be called "discolators." Simple linkage.

experimented with discs of various diameters (for engines as small as a .25 and as large as a .60) before they settled on a 30-inch diameter. This provides the most stable platform without compromising strength. I've made two Tuits: the first was an early generation kit; the second was from the current production run. The quality and accuracy of the foam-cutting has greatly improved. The

(Continued on page 35)

ROUN' TUIT



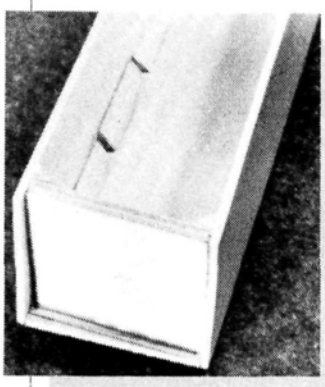
PHOTOS BY RALPH CLOUD

Parts layout. Easy to assemble. Largest pieces are cut from foam.

earlier kit had flat spots on the perimeter of the disc; the cut for the fuselage wasn't consistent from one disc to the next; and a balsa doubler was needed to allow for variations in cuts. Bonded Model Products began using computer-controlled foam-cutting, which is accomplished with a .001-inch water jet that's capable of great accuracy. In current kits, the cut of the disc is perfectly round without flat spots; the fit for the fuselage is consistent throughout the production run; and the doubler is no longer necessary.

The basic design consists of a 30-inch foam disc with 1/16x4-inch balsa sheeting on the center section and 1/16-inch balsa around the perimeter of the disc. A plywood box "fuselage" houses the radio and fuel tank, and the engine is mounted on its front. A foam vertical fin completes the basics; landing gear is optional. The Tuit is designed for fliers who have some building and flying experience, and who invariably have left-over pieces laying around; not much hardware is included in the kit. In fact, aside from the basic materials for construction, the only included "extra" is the mechanical mixer.

The Tuit is shipped in a 5x17x26 box, inside of which you'll find pre-cut foam for the disc halves, the elevons and the vertical fin. The fuselage uses 1/8-inch aircraft ply; balsa is used for the rest. You'll also find materials to construct a sliding-servo-type mechanical mixer for the elevons. The improved directions consist of four pages of text and five illustrations which use computer graphics to provide all required assembly information. The directions that came with the first-run kit were lacking in several areas (improper construction sequence and omission of certain required steps); these shortcomings have all been corrected.

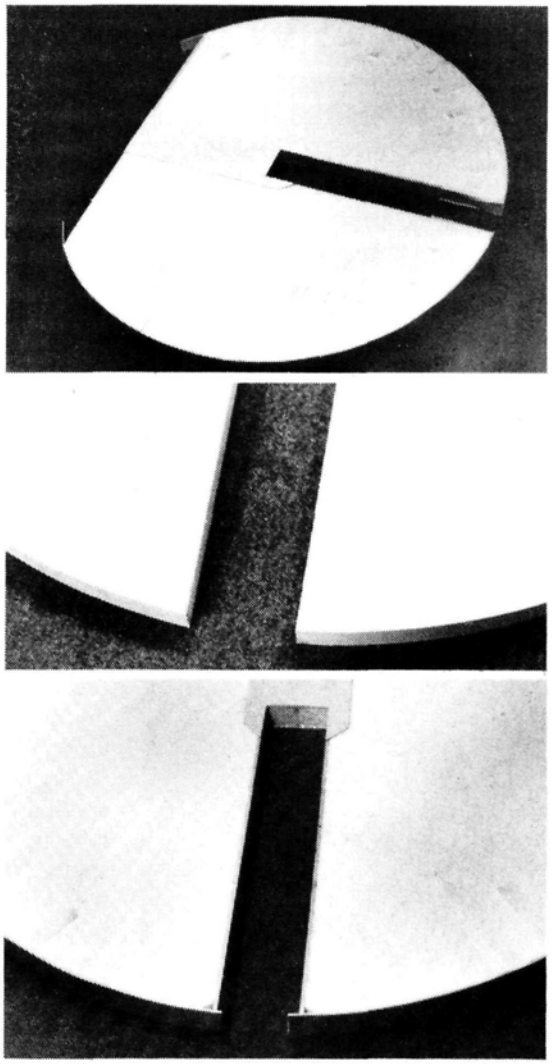


Forward end of fuselage box; note the firewall offset for the 1/8-inch downthrust and 1/8-inch right thrust.

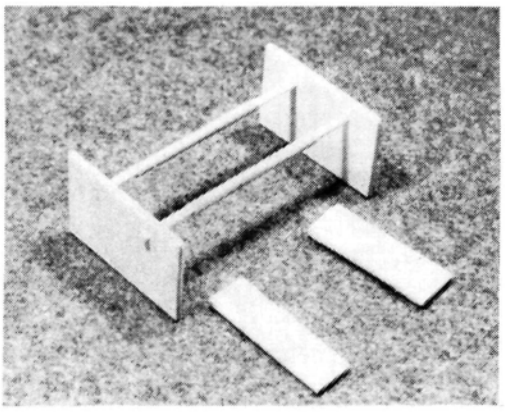
GETTING DOWN TUIT

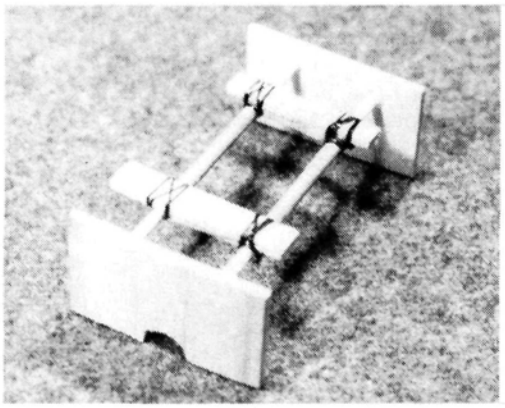
Read all the instuctions before starting (I know you always do). Construction begins with the disc assembly. Satellite City's* UFO can be used on the foam without the problems usually associated with instant glues on foam; it provides a good bond without the mess and waiting time of epoxy. The firewall is the only place where epoxy is mandatory.

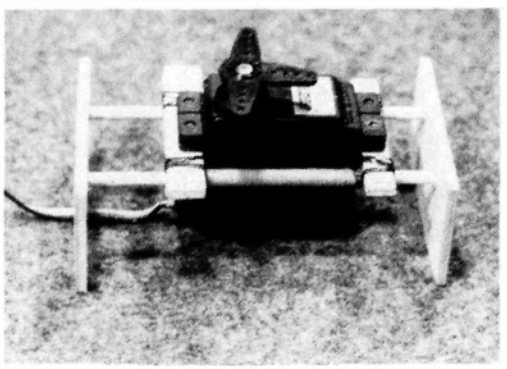
First, join the disc halves, then add the trailing-edge stock for the rear spar (the



Top: Disc doublers and rear spar installation; tape used to hold disc edging in place. Center & Bottom: Gap on first-generation kit; note the balsa doubler. Both gap and balsa doubler are eliminated in the kit that's now marketed.







Various stages of the sliding elevon mixer.

wide edge of the stock goes at the top). When you mount the trailing-edge stock to the front of the elevons, be sure to make a left and a right side. (The angle of the stock allows the surfaces to move up and down.) To allow more down-throw, sand the front of the elevons before mounting the trailing-edge stock. Glue the 1/16-inch sheet doublers to the center top and bottom of the disc, overlapping the rear spar. I found that the thick (high-viscosity) UFO works best. I applied the glue to one surface, sprayed the other with kicker, then pressed them together; the bond is almost instantaneous. Glue the 1/16x1-inch strip to the outside of the disc and elevons. For the control horns, flush-mount a 1-inch-square piece of 1/8-inch ply on the elevons. The disc is nearly ready to be prepared for covering. This portion of the construction took a leisurely 2 or 3 hours to complete.

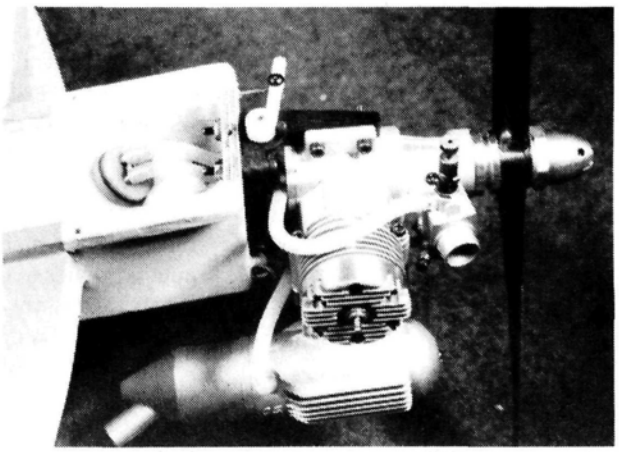
The fuselage or "box" is made of 1/8-inch lite-ply. Select one of the three identical boards and glue the left and right sides to the outside of the bottom. Epoxy the 5-ply, birch firewall with 1/8-inch right thrust and 1/8-inch downthrust, using the supplied 1/4-inch triangle stock behind the firewall for extra strength. The fuselage rear wall is installed and reinforced with 1-inch lengths of triangle stock.

At this point, the plans mention that many Tuit owners hand-launch their models. If this isn't your intent, glue a ply doubler to the inside floor of the fuselage to provide a solid attachment point for the landing gear.

The elevon mixer is constructed from two pieces of ply; 1/8-inch dowels pass through sections of outer Nyrod tubes between the ply. The aileron servo is mounted on rails that are glued to the tubes. The elevator servo is connected mechanically to the aileron servo. When it moves, it also moves the aileron servo, and this causes both elevons to move in unison. When the aileron servo moves alone, it moves the elevons independently. This simple elevon mixer is harder to describe than to construct! When the mixer is finished, install it in the fuselage, as far to the rear as possible. The fuselage box is then glued into the slot of the disc.

The leading edge of the rudder is sanded to a 1-inch radius, then glued to the disc, as far aft as possible. After a quick sanding, the Roun' Tuit is ready for covering. I used a combination of Goldberg* Ultracote and Hobby Shack* Solarfilm. To hinge the elevons, I used the covering material (guidance is provided in the instructions).

I installed a World Engines* Expert 7-channel FM radio. Although the kit instructions don't provide specific information for the radio installation, they do recommend throws for the elevons. I installed the aileron servo on the sliding servo tray in the mixer; the elevator, steering and throttle servos were mounted crosswise in the fuselage. To obtain the specified balance point (which is 6 1/2 inches aft of the leading-edge junction of the disc and fuselage), the battery had to be installed between the servos and the mixer. The receiver was



O.S. engine provides plenty of power. Reliability is extremely important, as Tuit relies on prop thrust rather than the "wing" (disc) to fly.

placed between the servos and the fuel tank.

When I first installed my radio, I had the elevator servo connected to the sliding tray on the mixer by connecting a pushrod to a tab I had left on the forward servo rail of the aileron servo in the mixer. It failed on the third flight, partly because I made a hard landing. I recommend that you connect the pushrod to one of the servo-mounting screws on the aileron servo, or at least attach it very securely.

I powered my Tuit with an O.S.* .40 SF engine that I mounted sideways. I used a Hayes engine mount, which allowed the nose wheel strut to be mounted through the engine mount. For the main gear, I used a dural-type gear I had laying around.

FLYING RIGHT TUIT

The flying characteristics of the Tuit are unusual to say the least. The instructions explain that the Tuit "flies on engine thrust and not lift....It's a stable engine aiming platform, not an airplane....The Tuit will fly like any shoulder-wing airplane—takeoff to landing—when flown like a sport plane, but it will do much more."

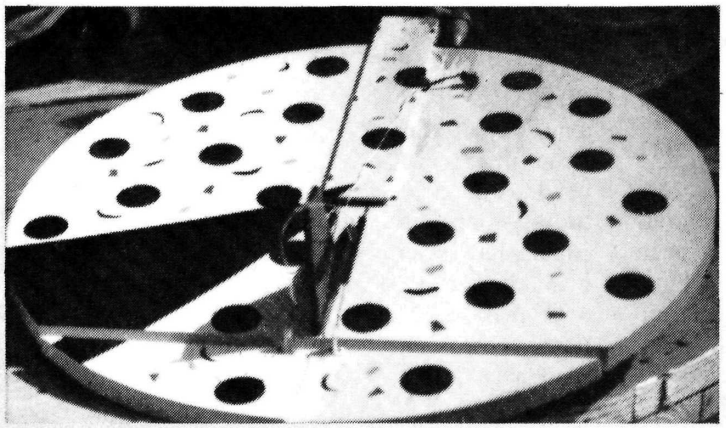
After the required control-throw and range checks, it was time to see how this strange craft would perform. The takeoff run was straight; with some ground speed, up-elevator rotated the Tuit, and it was airborne. It was a strange sight! I trimmed with just one click of aileron and two or three clicks of up. It was really

(Continued on page 114)

Getting a Roun' Tuit!

A Reader Report by WHITNEY OWENS

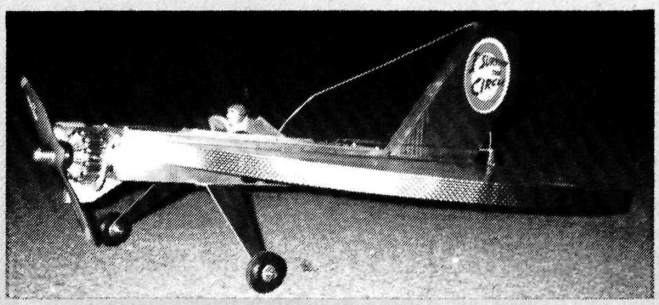
—from Eden, TX



Here are some photographs I took at the Angelo R/C Club fun fly in San Angelo, TX. I've been taking photographs since '78, but I'm fairly new to the R/C hobby, and I've enjoyed it more than I ever imagined I would. In my little town (Eden, TX), there are only two people involved in R/C, but I'm trying to spur interest. Several of the photos show Roun' Tuits. If you've never seen them fly, the moves they're capable of will surprise you!

He got a Roun' Tuit, too!

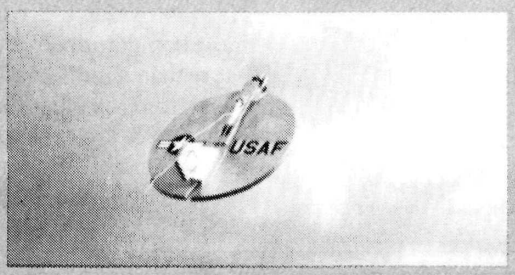
A Reader Report by KEVIN FOTORNY
—from Huntsville, TX



Are the skies down there filled with these things?!
A tail-dragging spacecraft? No, it's a Bonded Products Roun' Tuit.

Special features: O.S. Wankel engine; conventional landing gear.

Comments: performance is vertical on takeoff, and landings resemble WW II carrier-plane technique: nose high, flown to the deck.



The Roun' Tuit loops inside or outside, and it rolls as if it flew on a wire. My verdict? A lot of "bang" for the bucks (those good ol' boys in Austin did good!).

(Kevin, your subscription is waiting but we need your correct address.)

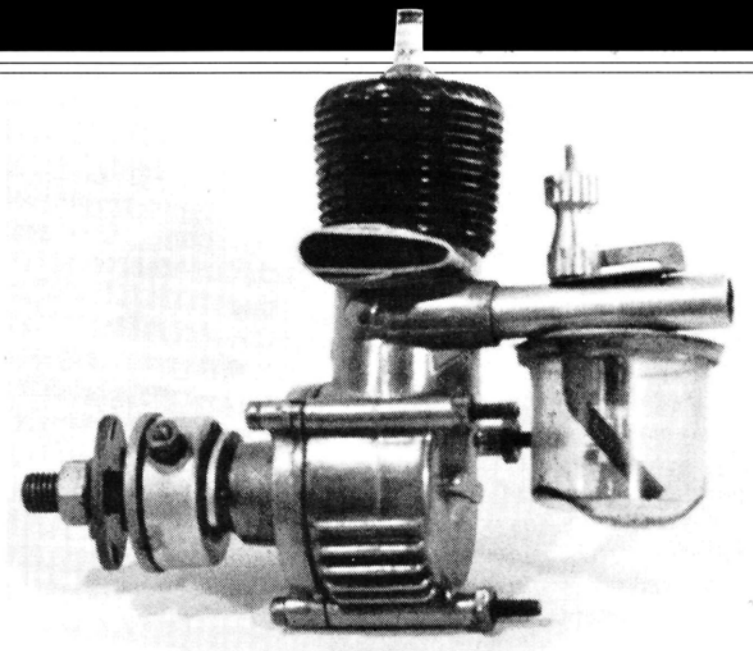
ABOUT THOSE ENGINES

by JOE WAGNER

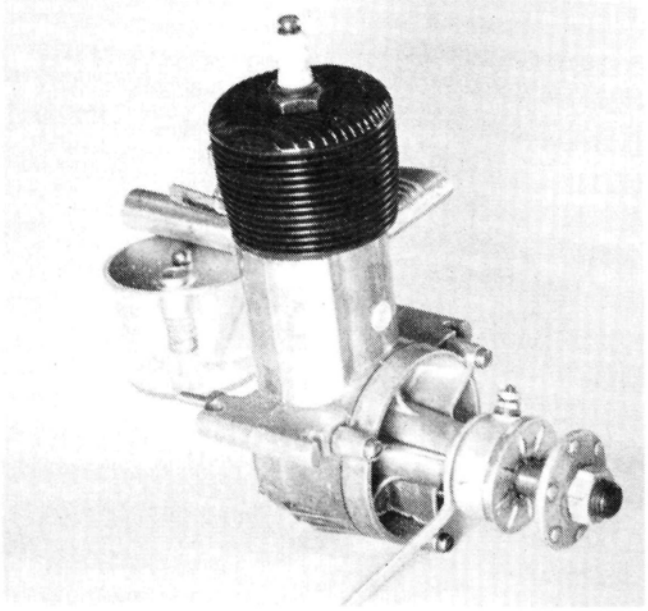
Early engines and a series of Ohlsson "firsts"

MINIATURE aircraft engines have been around for a *very* long time. The earliest successful one was flown in a model by John Stringfellow—indoors in a vacant English lace factory—in 1848. This was a steam engine; another fifty years elapsed before a model airplane flew with an internal combustion motor for power. It wasn't until well after Lindbergh's 1927 trans-Atlantic flight that model-airplane hobbyists were able to buy a mass-produced engine designed for their use: the famous "Brown Junior" .60 of 1934. In the 56 years since then, almost 4,000 different makes and versions of these model-airplane engines have been manufactured.

Of these 4,000 types, I've seen specimens of perhaps 1,200. Some, like the infamous "Thors" and "Deezils" of the mid-1940s, were hopeless trash; others, such as today's Technopower multi-cylinder radials and the O.S. FF-240 horizontally opposed 4-cylinder engines, are miracles of ingenious design, superb craftsmanship and efficient operation. Between these extremes lies a wide spectrum of model motors. Some of these powerplants did their job satisfactorily enough, but weren't especially memorable. Others possessed such a strong "personality"—good or bad—that nobody who owned one could forget it.



The first postwar O&R .23s had no beam-mounting lugs. Modelers didn't care for this version, so few were sold. It's now a collectors' item.



The shiny circle on the 23's case shows that the aluminum case and steel cylinder were spot-welded together. Supposedly an impossible job, O&R did it on every .19, .23 and .60 they made.

THE O&R .23

If I was compelled to choose my own favorite from all the model motors I've ever used, it would have to be the Ohlsson .23: the original "sideport" type made from 1938 until 1950. During much of that time the 23 was by far the world's most popular model engine. More than a million of them were sold by the makers (Ohlsson & Rice, commonly referred to as O&R).

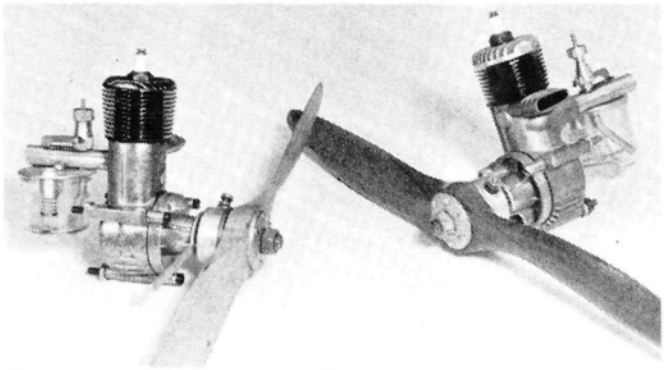
For its era, the O&R .23 embodied the best combination of features possible in model powerplant design. It was an ideal size for a modeler who needed easily transportable airplanes. Instead of the 6- to 8-foot wingspans required by .60 displacement motors, the 23 worked fine in 4- to 5-footers. The Ohlsson was easy to operate as well—but not too easy: it provided just enough of a challenge so that starting and running it never became boring. Although the 23 was far from what could be considered a high-tech competition engine, it won and placed in more model contests during its heyday than all of its competitors put together.

The 23 was simple to maintain, too. Hobby shops all over America carried a complete stock of replacement parts for it. The only

(Continued on page 42)

thing that you had to order from the O&R factory in Los Angeles was the cylinder/case/piston assembly, available strictly as a custom-fitted set. (These three components were manufactured with unique processes, which no other model-engine maker has ever duplicated. That's why no one has made any replicas of the Ohlsson .23; probably no one ever will.)

The 23's designer, Irwin Ohlsson (alive and well in southern California) told me a curious fact about his little masterpiece: there was never any prototype made of it. The first production motor was *the* first 23! Irv said that his experience with earlier, larger-displacement model engines, such as the Ohlsson Gold Seal .57, showed that production motors with die-cast cases never performed the same as hand-built prototypes with all-machined parts. Thus, he and his partner Harry Rice concluded that hand-made experimental engines were merely a waste of time and money. Irv designed the 23 entirely on paper—the best he knew how—and it went straight into mass production.



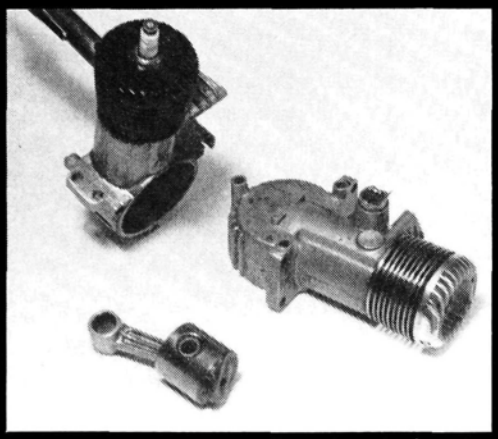
When compared, early prewar and late postwar .23s show no remarkable differences. Ohlsson .23s worked best with propellers with a 9- to 11-inch diameter.

This is not to say that the O&R .23 was perfect right from the start. It had a few minor bugs, and some parts required revision. During its dozen years of production, other small quirks turned up from time to time, and these necessitated further changes. All in all, however, Irv Ohlsson hit his design target mighty close to the center. The last O&R .23s that were made differed only slightly from the original version.

Another "first" for the 23: it was the earliest production model motor whose speed could be varied by remote control. Jim Walker (inventor of U-Control) devised the setup: the ignition timer contained two separate sets of "points," which could be remotely switched on and off to provide 2-speed operation. The original installation was hand-made for Jim's own control-line models, of course. It worked so well that the Ohlsson factory quickly issued a production version that any modeler could buy.

Jim Walker employed this same 2-speed system on the larger Ohlsson .60s in his radio-controlled airplanes—and won the R/C event at the Nationals more than once with its help.

So many Ohlsson .23s were manufactured that they're not at all rare today—40 years after the last ones came off the assembly lines. OT contest events—both free flight and R/C—for O&R .23-powered models have become so popular, there are probably more modelers participating in them now than in the modern free-flight events for the same engine-size class. It looks to me like the O&R .23 has become *the* classic among the 4,000 existing brands and types of model-airplane motors. Like the Model T Ford, the Ohlsson .23 will probably never become extinct.



Broken lugs and sawed-off intake tubes can be repaired by Vic Didelot. In front is the .23's unique hydro-formed steel piston and drop-forged aluminum-alloy connecting rod.

RESTORING OHLSSONS

Conditions are bleak these days for owners of old model motors who need replacement parts. One major supplier, Micro Model Engineering, was sold by its original proprietors some time ago. Since then, the tooling and inventory have gone through two changes of ownership, and it's uncertain just when the business will resume.

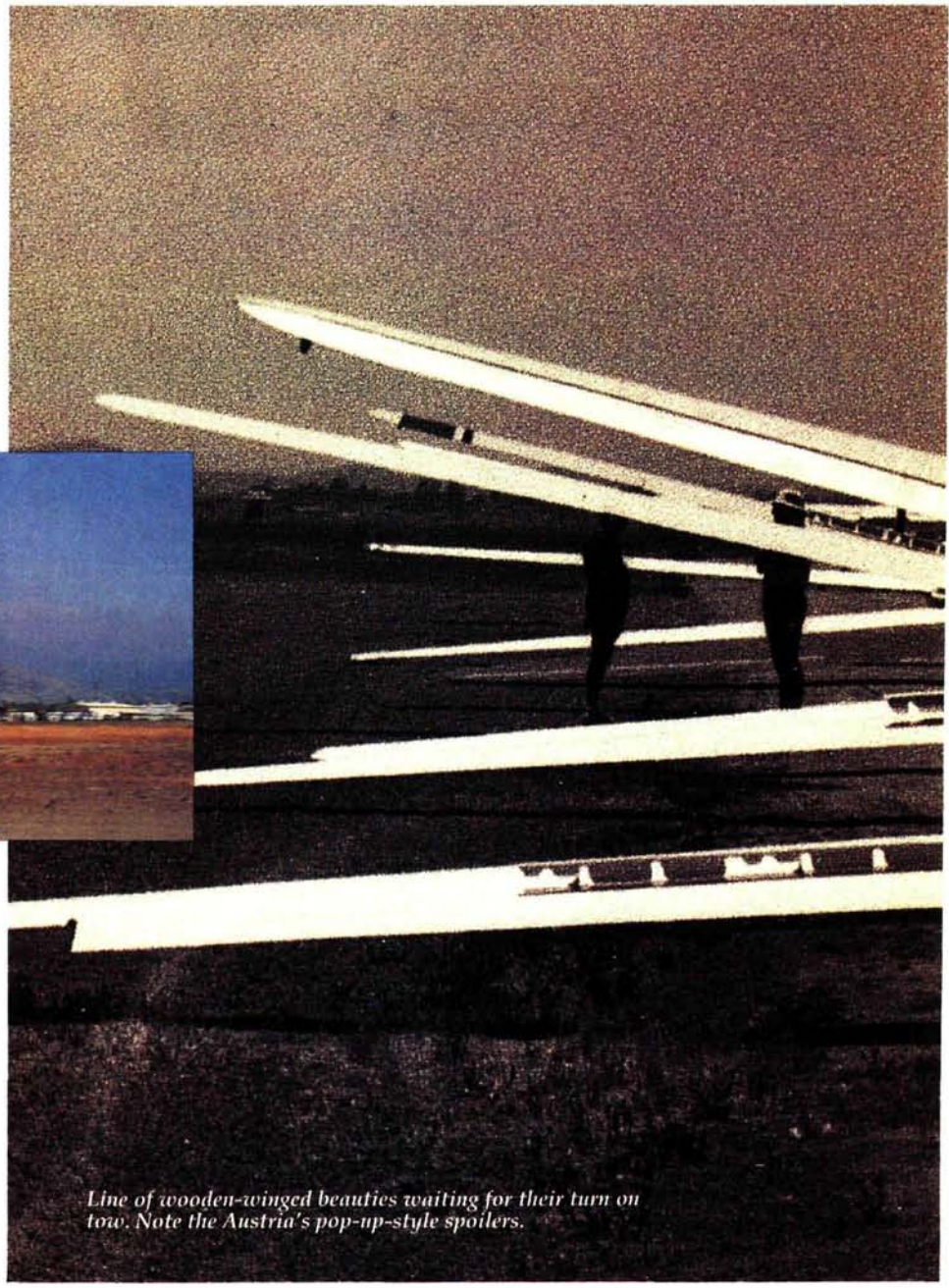
I have good news for O&R owners, however: practically all the parts they might need to keep their Ohlssons perking are available—and at reasonable prices—from an old-time modeler friend of mine, Vic Didelot*.

Vic not only supplies parts for O&Rs; he also does all types of restoration work, too. Is the paint on your Ohlsson's cylinder scarred and flaking off? Vic can repaint it so that it looks as good as new. Has some earlier owner sawed off the rear intake tube of your O&R to convert it to front rotary induction? Vic can install a new rear intake that you won't be able to tell from the original. He's even able to repair broken mounting lugs—Ohlsson's motors' only serious weak point.

Most model-engine repair services I know of take a long time to return customers' motors. Herb Wahl*, for example, does impeccable work—but he has such a backlog piled up, it may be many months before he can handle a repair job that comes in tomorrow. Vic Didelot provides much faster service than that. The last job he did for me took just a couple of weeks; and he seldom needs more than a month to complete even extensive restoration work on an Ohlsson of any kind: .19, .23 or .60.

**Here are the addresses that are pertinent to this article:*
***Vic Didelot,** 4410 Lorna Ln., Erie PA 16506.*
***Herb Wahl,** P.O. Box 61, Forksville, PA 18616.* ■

A visit to a scale soaring fan's dream



Line of wooden-winged beauties waiting for their turn on tow. Note the Austria's pop-up-style spoilers.

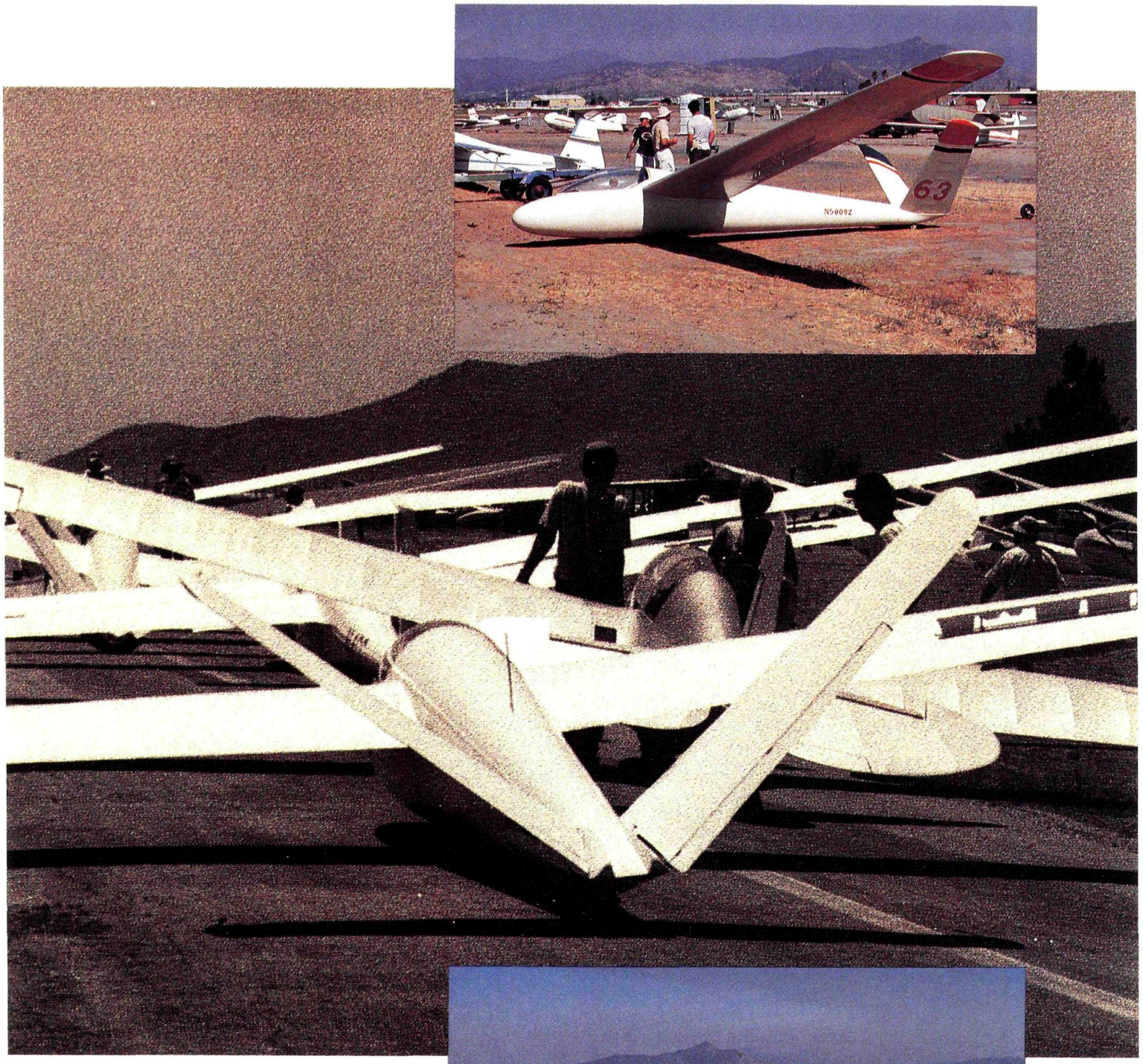
by JOHN LUPPERGER

IS THE HISTORY of soaring worth preserving? I think so! If you're interested in vintage sailplanes, join the Vintage Sailplane Association*. Formed in August 1973, it has grown into a national organization of considerable importance to all sailplane enthusiasts. As part of its preservation efforts, the Association has set certain goals:

- To search worldwide for classic gliders and sailplanes that can be restored for flight or for donation to museums;
- To provide members with plans for popular, easy-to-build gliders, so that home-builders can produce contemporary replicas for sport flying;
- To furnish microfilm copies of the designs and plans for both famous and obscure sailplanes to the National Air and Space Museum and the National Soaring Museum;
- To recruit as members significant personalities from the history of sailplane and glider design, so that their knowledge can be added to these archival collections;
- To support

Seconds before touchdown, the LK-10A gives the pilot great visibility. From the rear seat, the side-to-side view is excellent, but forward, all you see is the back of the pilot's head!

VINTAGE Sailplanes



the activities of the National Soaring Museum;
• To provide those interested in vintage sailplane history, renovation and flight with information and interesting articles about the Association's activities through its newsletter—"Bungee Cord."

These goals are ambitious, but they'll benefit everyone who loves vintage sailplanes. "Bungee Cord" is reason enough to join the VSA; it's always full of interesting and informative articles, line drawings and photographs. VSA members fly many classic sailplanes, e.g., Minimoa, Wolf, Grunau Baby, Kirby Gull, Moswey, Schweizer 1-19, TG-2, TG-3, and 2-22, Laister-Kauffman LK-10 and "flat tops." Why not get involved?!

PHOTOS BY JOHN LUPPERGER

Dave Wood prepares to head for the line with his immaculate SHK Austria. This beautiful, clean sailplane won Best Classic.

Harry Irvine's orange-and-blue Schweizer 1-23 won Best Vintage Sailplane. It

L'il Dogie—winner of the Oldest Sailplane award—before being assembled. Originally built in 1939, this plane has a lot of history behind it.

TAKING WING

During the 1989 Memorial Day weekend, VSA members got together for the 2nd Annual Western Vintage Sailplane Regatta at Sailplane Enterprises, Hemet-Rytan Field, CA. Although this was only its second year, participation was almost double, and there were seven vintage and

SCREAMING WEINER TO L'IL DOGIE—RELISH THE HISTORY

IN 1938, THE CROWN City Glider Club of Pasadena, CA, began construction of a small sailplane. Designed by Irv Culver and built to fit the limited workshop space, it ended up with a fuselage length and half-span of 18 feet, 4 inches. The fuselage was made of plywood, and the wooden tail surfaces and wings were fabric-covered. Because its all-up weight was only 500 pounds, this maneuverable glider could work very small thermals.

In 1939, Irv Culver test-flew his plane at Tehachapi, CA. Because of the distinctive whistling sound it made in flight and its bright red paint job, the ship was dubbed the "Screaming Wiener"! In 1940, it was flown at the Arvin Meet by Wally Nugent (one of the original builders), and at the Southwest Soaring Contest in Wichita Falls, TX.

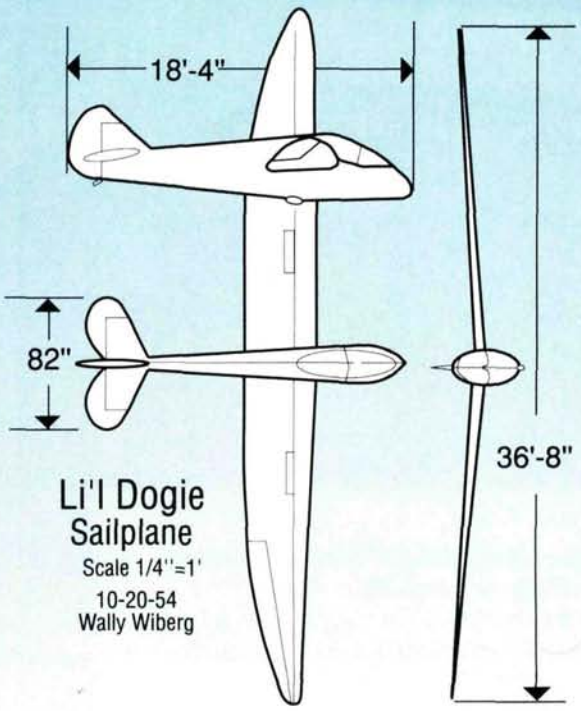
After being flown at Arvin again in 1941, it was sold to Frank Boggs, who flew it at the Elmira 1941 Nationals and recorded a flight of 1 hour, 20 minutes. Frank then took the Weiner to Rosemond Dry Lake, CA, where he and several other pilots made many flights by auto tow, the longest of which was 2 hours, 10 minutes at 5,000 feet.

After Frank Boggs' death, the ship was sold back to the Crown City Glider Club, but it wasn't flown until 1944 at Bishop, CA. Two more years went by before the Wiener took to the sky again—this time in Twentynine Palms, CA, with Ray Parker at the controls. Ray made several cross-country flights, including one all the way to Wickenburg, AZ! He placed 2nd at the Elmira 1946 Nationals with the Weiner.

Next, the Club sold the ship to Paul Tuntland, who took it to Sanford, FL, where he attained an altitude flight of 15,500 feet. The Wiener was then acquired by Paul MacCready Jr. (where have you heard that name?!) of New Haven, CT, who took the ship to the Nationals at Wichita Falls, TX. In just over three weeks, Paul recorded more than 1,870 cross-country miles and two Gold "C" legs, and set a world out-and-return record of 230 miles!

In 1948, Gordon Winfield (of Dallas, TX) bought the plane. He re-covered and painted it, but never flew it. He sold the ship to Beaumont Cooley Jr. the same year. Beaumont flew the ship in Grand Prairie and Odessa, TX, until 1951. His flying included airshow aerobatics, a Gold "C" altitude and a cross-country flight of 154 miles.

The next proud owner—Wally Wiberg of Grand Prairie, TX—renamed the ship "L'i! Dogie" and made a major modification by changing the turtle deck and adding a large bubble canopy modified from a Bell helicopter. These changes eliminated the whistle that had earned the ship its original name. Wally flew the ship between 1952 and 1955, and logged more hours than any other pilot. The ship was then put into dry storage in San Diego, CA.



Wally donated the ship to the San Diego Aerospace Museum after a fire in 1978 destroyed most of its aircraft collection. The staff there repainted the L'il Dogie in its present cream-and-red scheme, but the museum decided not to use it, and the Dogie was sold to Jim McDonald in 1981. Jim sold it back to Paul MacCready in 1983, who sold it to its present owner, Bob Fronius, in 1985.

Bob has owned the ship ever since, and he's kept it in top flying condition. The Dogie still takes to the air regularly at VSA meets! With upwards of 500 flying hours, the L'il Dogie has certainly earned its place in soaring history!

(Special thanks to Doug Fronius for providing this information.)

five classic sailplanes! (Vintage ships are those designed or built before 1957; classics are at least 25 years old, but not yet old enough to be vintage.)

The organization of the event was much like that of some model meets. The flying events included longest duration, spot landing and speed triangle.

On Saturday, I got to ride in Doug Fronius' 1943 LK-10A in his attempt at the speed-triangle course! There was very little lift, so we couldn't gain enough altitude to head for the first turn point, but that didn't matter to me; the time I spent aloft in this vintage sailplane was exciting in itself! During the first year's event, I was lucky enough to pilot the LK for a short time! Someday, I'll have to build a 1/4-scale version.

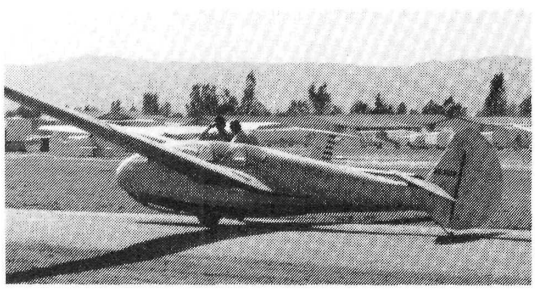
As it turned out, the lift was so bad that eight attempts were made at the course, with no completions. Nevertheless, Lee Maxson stayed aloft for 2 hours in his SHK Austria—the longest-duration flight of the meet! It's amazing that he could stay up this long, but he couldn't make it around the course!

LOOK OUT FOR THAT BRICK WALL!

I was unable to attend the Regatta on Sunday, but special thanks to Doug Fronius for telling me about the day's events. Spot-landing was held Sunday morning. This contest works much like the spot-landing part of our model competitions, but there's an imaginary brick wall in front of the spot. If any part of your aircraft hits this "brick wall," your attempt doesn't count. Bill Knoll was the unofficial winner, at 2.0 inches; one of his home-built Woodstock's wing tips hit the "wall". Wish I could do that well with my models! At 5.75 inches, the official winner was Jeff Byard in his SH-1 Austria. Talk about precision landings! These guys are really good!

Lift improved Sunday afternoon, and the speed-triangle course was finally conquered. Chris Hardenbrook completed the 20-mile triangle in his SH-1 Austria at an average speed of 53mph.

There were many beautiful aircraft present, any of which would make a great modeling project. Certain ships really caught my eye, including Doug Fronius' LK-10A two-place trainer. There's a magical quality about this ship's curving lines that draws people to it, and flying in a glider that's



Doug Fronius waits his turn for an aero tow. Most tows are to approximately 2,000 or 2,500 feet. Under the designation TG-4A, the LK-10A was an Army Air Corps trainer.

Above: I took this shot of one of the Austrias while Doug and I worked a small area of lift. The light streak is created by the curvature of the LK-10A's canopy. The view from up there is fantastic!

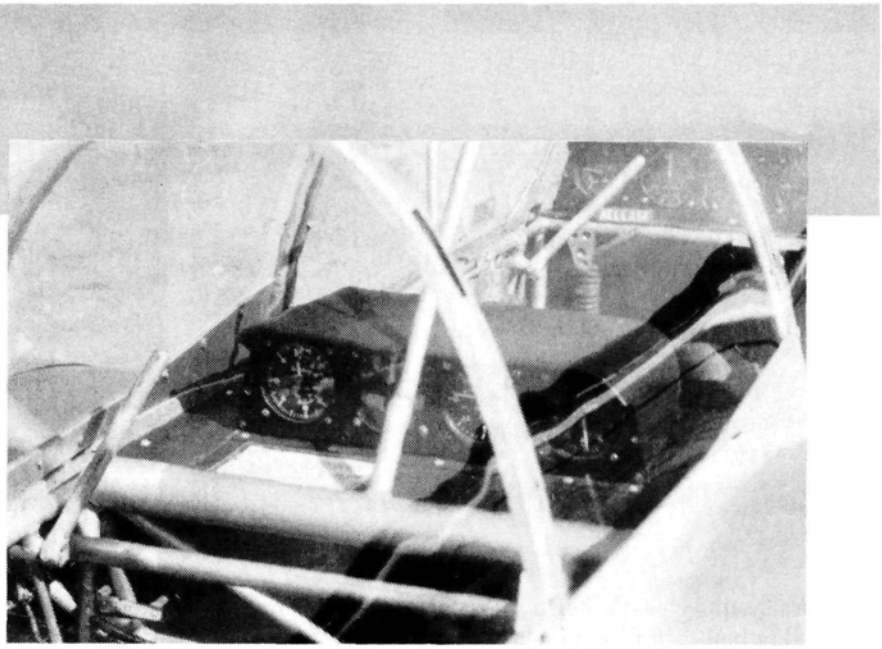
Above left: It's hard to believe that Bill Meyer's LM-1 started as an LK-10A! Modifications include a new canopy, rear turtle deck, tail surface and a retract wheel with

PARTICIPANTS—WESTERN REGATTA

VINTAGE SAILPLANE	
Bob Fronius	1939 L'il Dogie
Doug Fronius	1943 LK-10A
Bill Meyer	1943 LM-1 modified LK-10A
Harry Irvine (event director)	1949 Schweizer 1-23
Bill Irving	Cherokee II
Bill Knoll	Woodstock
John Bender/Jerry Johnson	Schweizer 1-26

CLASSIC SAILPLANE	
Jeff Byard	SH-1 Austria
Chris Hardenbrook	SH-1 Austria
David Wood	SHK Austria
Lee Maxson	SHK Austria
Doug Fronius/Hernan Posnansky	White Knight

AWARDS	
Furthest Distance Travelled	Bill Meyer, LM-1, 554 miles
Youngest Pilot	Lee Maxson, SHK Austria, 28 years
Oldest Pilot	John Bender, Schweizer 1-26, 82 years
Best Vintage	Harry Irvine, Schweizer 1-23
Best Classic	Dave Wood, SHK Austria
Oldest Sailplane	Bob Fronius, 1939 L'il Dogie
Spot Landing	Jeff Byard, SH-1 Austria, 5.75 inches
Longest Duration	Lee Maxson, SHK Austria, 2 hours
Speed Triangle	Chris Hardenbrook, SH-1 Austria, 53mph



Although the LK-10A is a large sailplane, the area under the "greenhouse" is tight. There's a lot of tubing, and if you put on a parachute, there isn't much room to move around!

There's a magical quality about the LK-10A that draws people to it, and flying in a glider that's older than you are is a real treat!

older than you are is a real treat! This aircraft's accomplishments include a distance flight of 205 miles by Richard Lyon in 1952, and an high-altitude flight of 27,900 feet by its present owner in 1989.

THE WHITE KNIGHT

One of the meet's high points was the appearance of the White Knight owned by Doug Fronius and Hernan Posnasky. Hernan's presence made the occasion complete, as he was one of the aircraft's original designers. The White Knight was the 1962 prototype for the well-known Diamant sailplane. A unique feature of this plane is that its beautiful wings are built-up (the production Diamants' wings were glass): Also present was a 1965 Diamant HBV that was no. 7 off the production line!

YOUR TURN!

I'll let the pictures tell the rest of the story. I hope these aircraft shots excite you enough to try your hand at a scale sailplane project! If you decide to build a vintage model, the VSA can be very helpful in locating drawings, original plans and documentation.

If you're in Southern California over the Memorial Day weekend, try to make it to Hemet-Ryan Field for the 3rd Annual Western Vintage Sailplane Regatta. If you're on the East Coast, head to Harris Hill, Elmira, NY, for the 17th Annual Eastern Vintage Sailplane Regatta. You'll see some beautiful vintage sailplanes. Who knows?—you might even get to go up in one of the many two-place trainers that take part in the activities!

**Here's the address of the organization featured in this article:*
Vintage Sailplane Association, *Scott Airpark, Route 1 Box 239, Lovettsville, VA 22080.* ■

FLOATING AROUND

SCHNEIDER SAVOIA PROGRESS, WATERBORNE WACOS AND X-WINGED AMPHIBS

by JOHN SULLIVAN

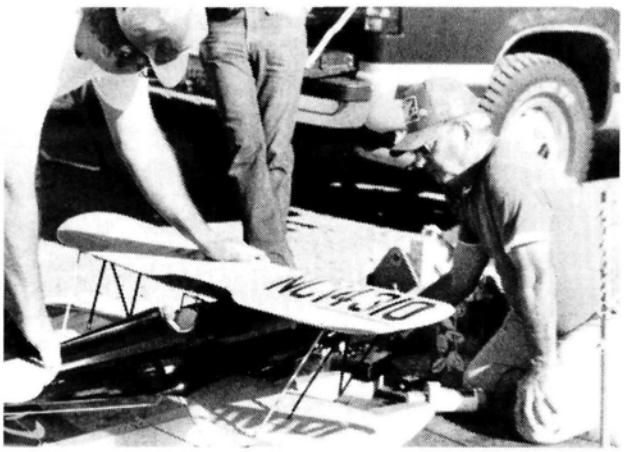
Dick Lemme's Waco Bipe charges out of the hole on 36-inch Goldberg floats. Waterproofing is important with vee-bottoms, which produce a higher spray pattern.

FLOATING MAILBAG

I received a nice letter from Joe Murray of Unionville Hobbies* about our review of the 63-inch Norseman. Joe writes that others had the same instability problem as Jimmy MacDanald when he flew the Norseman on floats. The remedy is to move the CG forward 1/2 inch when you mount the floats. Joe never realized they had a problem, because he had moved up from a .29 to a .40 on the company prototype, which effectively added enough weight to move the CG forward 1/2 inch!

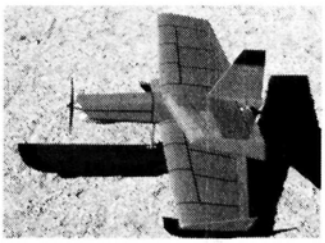
To clear things up, Unionville has amended its instructions. Joe doesn't know this, but I just received a letter from Bil & RC Hobby—a big model distributor in Sweden. They started carrying the Unionville line after reading about Joe's kits in *MAN*. Good work, Joe! It's wonderful to watch those who persevere and break into the mainstream.

Bud Schweisinger* sent me a photo of his scratch-built 86-inch Beaver, and he told me that I goofed! It seems I reported that the Portland Sky Knights were the hosts of the Plat One Float Fly, when, in fact, it's Bud's club, the Umqua Valley Modelers who put on that meet. Bud says the Umqua Valley group tried to throw him through a window when they read the mistake. I never realized I had so much influence! Anyway, the Umqua Modelers host the Plat One Float Fly, the Portland Sky Knights host the N.W. Seaplane Championships, and I promise never to forget. Schweisinger's life is at stake! Bud also informs me he's trying to organize a trade-a-tape system between clubs in the States. He says early response to the idea is very positive, and he has had inquiries from as far away as Michigan and North Carolina. Contact Bud at the address listed if you want to get into this network.



Dick Lemme runs up the .61 FSR on his Pica Waco. Note triangular rear float strut. Bipe uses stock main gear.

Clearlake will be happening at just about the time you read this. Bill Evans* sent me a little teaser about it and a photo of an O.S.-powered Astron .60 from his Simitar Series. Bill says it flies as well as it looks. We'll try to get more on this X-wing at the meet, but listen to this: Bill also tells me they may have a 7.5 ducted-fan at Clearlake! Watch for my report in September or October.



Bill Evans' Astron .60 will appear at Clearlake 1990. See text for details.

LEMME PICA WACO

The foregoing isn't an obscure Mayan Harvest chant. It's a lead-in for my review of a 60-inch Pica kit of the Waco YMF-3 on Goldberg* floats that was built by Dick Lemme of Santa Rosa, CA. Dick's Waco weighed 10 1/2 pounds, which is quite reasonable for a .60-size bipe on floats. Covered with super-shrink Coverite* and finished in yellow and black Formula *U*, the model has simulated rib stitching, pink-

FLOATING AROUND

ing tape and much scale detail. As president of the Marin, CA, R/C group, Dick had the option of setting the Waco up on wheels to fly at the Marin site, or on floats to fly at ours. He reasoned that as a .60-size tail dragger, the bipe might be a handful, so he installed 36-inch Goldberg floats epoxy-glassed with 6-ounce cloth.

As a floatplane, the Waco tracks unerringly on takeoff and comes back down like a slot car on a long, straight track. In between, things are a little different. Dick describes the Waco as "not real easy to fly." He found it easy to trim on the first flight, but it was faster than he thought it would be, and it required constant attention. He thought it would snap fast if he got too close to the threshold, and he was very careful not to get behind on power.

I occasionally have to remind myself and my

(Continued on page 116)

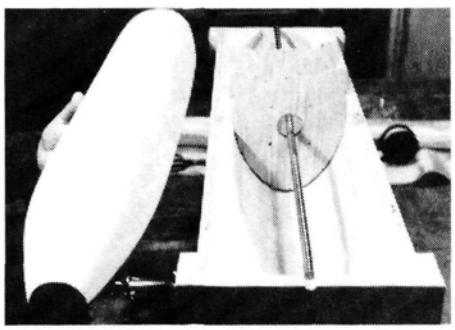
Harold Schweisinger's son, Buddy, displays Harold's scratch-built Beaver. Neither of these gentlemen is a member of the Portland Sky Knights.

THE SCHNEIDER CORNER

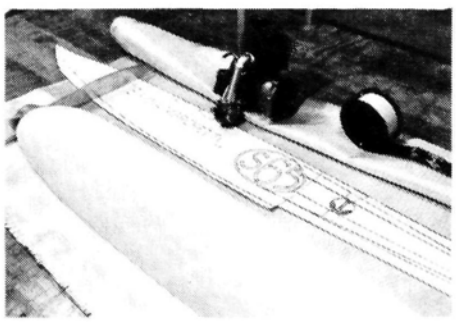
The Havasu Desert Hawks have recuperated from their all-out bash, and, once again, they're producing a steady stream of newsletters and correspondence. Club Secretary Larry Tate says they never expected such a tremendous response. As a result, the Hawks have decided to spread the Schneider event and the London Bridge Fun Fly over two consecutive weekends.

The second Schneider recreation will be held on November 2, 3 and 4, and the fifth London Bridge Seaplane Classic will be held on November 10, 11 and 12. If you suspect that these two meets will give modelers and spectators an excuse to stay at sunny Lake Havasu for 11 days, you're absolutely right! Are things getting out of hand? Who cares. While discussing the Havasu dates with Ken Runestrand, I learned it's now possible to start out with Oshkosh and hit a major modeling event every weekend thereafter for *three months!*

The Savoia Marchetti project is coming along. After much study, Mike Johnson and I found our starting point had to be scaling the fuselage to size to accommodate the Zenoah* G62. Working with a set of Hirsch five-views, we decided on a fuse width of approximately 6 inches. This gave us a scale of 23 percent and a span of 92 3/4 inches, which exceeds the contest rules' maximum wingspan of 85 inches. At that point, we "whited-out" the full-scale dimensions on the Hirsch Views and enlarged them until we could read the final dimensions of the model right off a 1 1/2-inch-to-1-foot draftsman scale.



Belly-pan plug for Johnson & Sullivan's Savoia Schneider entry is shown on left; lay-up mold on right. Note 7/16-inch drill-rod shaft for push/pull racer.



Johnson's G62 with custom remote carb is dwarfed by side view of Savoia's float. Five-ounce Kevlar and carbon-fiber tape will be used to lay-up belly pan.

Next, we wrote to Jack Wismar for our ship's performance specs based on known dimensions, horsepower and projected weight. We also borrowed an opaque projector and developed some full-size templates on butcher paper for all the major components. Mike, who will undoubtedly carry the heavier end of this project, decided that no matter what Wismar's figures told us, we'd have to get the Zenoah running with fore-and-aft shafts and props to test for rpm and static thrust.

Using the butcher-paper plans, we made top and end templates, and we hot-wired a foam belly-pan plug in my shop. Mike took the plug home, sanded it to its final shape, sealed and waxed it and finally poured plaster around it to make a female mold of the fuselage belly pan for glass lay-up. You can see the mold in one of this month's pictures, along with a couple of 1/4-inch birch-ply bulkheads and the 7/16-inch drill rod, which we'll use for the shafts.

In the next phase, using 6-ounce glass cloth, 5-ounce Kevlar, carbon fiber and epoxy, Mike will lay up the pan, complete with front and rear bearings. Everything comes together on the pan, and it has to be rigid, light and bulletproof. Meanwhile, I'll be cutting cores for the wings and floats, glassing the floats with Kevlar, and sheeting the wings.

Jack Wismar's report came back, but we've only had a short time to analyze it. Based on the info we gave Jack, he thinks we can hit 80mph (well above our required 60.5 target speed) swinging two 18x10 props. Jack has extreme reservations about the Savoia's flying ability, and he predicts it will be very pitch-sensitive on the longitudinal axis. This makes sense, since the real one crashed because of the same malady. We've already approached our local airfoil wizard Fred Constantine, and he's looking for an airfoil that isn't pitch-sensitive and can be used on the Savoia. It will probably be a modified Quabek like those used on FAI gliders, which require both speed and duration capabilities. I'm glad Mike is going to fly this thing!

While Fast Eddie is aerobatic and responsive to controls, it can flatten out and fly a docile pattern as well. Here, the plane makes a low, slow pass at one-third throttle.

MIDWAY MODELS

FAST EDDIE

Ready to stretch the electric performance envelope? This kit may be just the ticket!

Louis Garwood holds the airplane after a test flight. Lou liked the model's flight performance so much, he's building one for himself!

by DAVE GARWOOD

WHAT'S THE MATTER? You say your flying buddies don't recognize Cuban Eights performed by your bent-wing motor glider? Your kid makes fun of how sl-o-o-o-wly you fly with your motor sailplane? The last 20 flights of your Electro-Glideabout didn't press your skills enough to stop your heart even once or twice?! Cheer up—there's a solution to your problems!

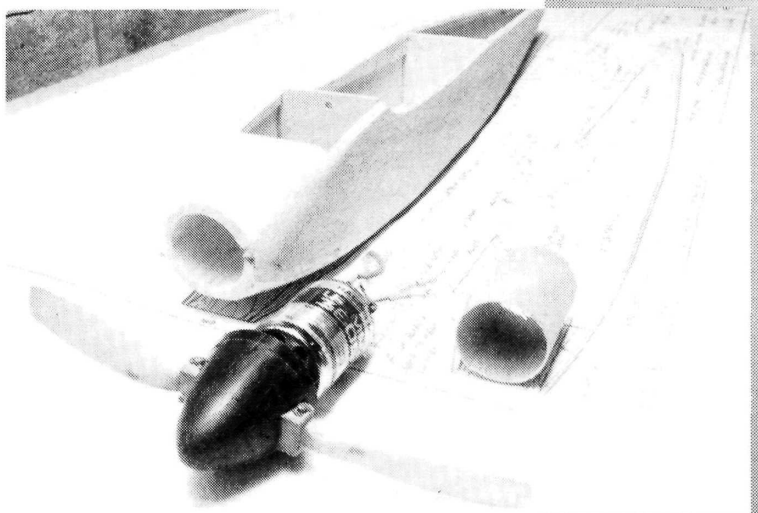
If you've mastered slow, gentle electrics, and you're ready to stretch the envelope, Midway Models* has a plane for you. The Fast Eddie is an inexpensive, speedy, aerobatic electric airplane that will get your heart rate back up there! Guided by aileron and elevator control, and powered by an 05-size motor, it's designed to be aerobatic and competitive in pylon racing. The Fast Eddie is easy to build and exciting to fly!

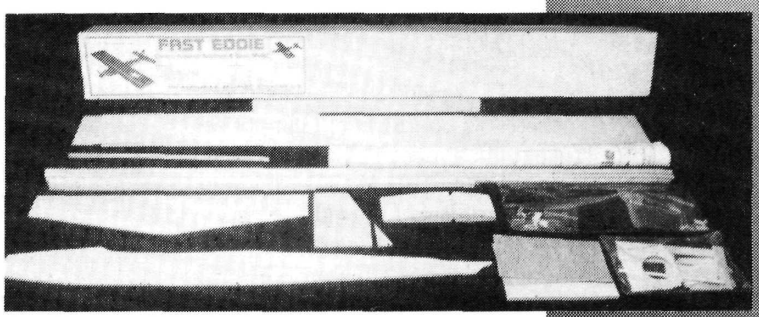
The kit includes carefully selected balsa and plywood, rolled full-size plans and six pages of instructions. Ribs, bulkheads and tail-feather parts are machine-cut. The complete hardware package includes aileron rods, threaded control rods, nylon elevator control horn, nylon clevises, molded plastic hinges and a nylon wing-mounting bolt. The choice of motor, propeller and spinner is left to the modeler.

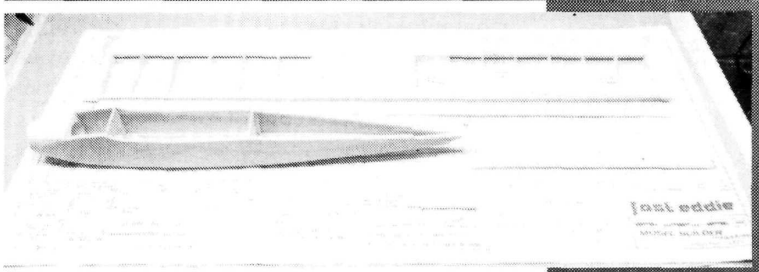
The nicely drawn, full-size, blue-line plans are detailed and complete, and they contain almost all the information experienced electric model builders will need. For less experienced modelers, the instructions include a detailed construction checklist. Construction photographs aren't provided, but the photos on the box let you see what the completed model looks like.

SPECIFICATIONS

Type: *Electric sport aerobatic/racer*
Wingspan: *29, 33 or 37 inches*
Weight: *33 1/2 ounces (as built)*
Wing Area: *217, 261 or 283 square inches*
Wing Loading: *17 ounces per square foot*
Power Req'd: *05 electric motor*
No. of Channels Req'd: *3 (ailerons, elevator, motor)*
Sug. Retail Price: *$24*
Features: *This highly maneuverable sport electric holds an unofficial speed record of 92.5mph!*
Comments: *Easy to build using traditional balsa construction, and surprisingly easy to fly if you have some aileron experience. The manufacturer cautions that the Fast Eddie is for experienced R/C pilots.*







To complete the airframe, all you need are adhesives and covering material.

EDDIE IS BORN

This kit's construction materials and techniques are traditional. I followed the sequence given in the instructions, and the steps were presented in a logical order. Major components are built entirely of medium-density balsa, with birch ply and balsa bulkheads. This is a sign of the kit's quality, as I find balsa to be stronger and more damage-resistant than the light poplar plywood that comes in some kits.

The builder can choose from the three wing lengths shown on the plans. Select a shorter wing for speed, or a longer one for aerobatics; sufficient materials are provided for each. (I built the maximum wingspan of 37 inches.)

There's only one trick to remember when building the wing: because it has a semi-symmetrical airfoil, place shims under the front of the ribs when the wing is pinned to the building board.

To assemble the fuselage, glue the longerons and the wing saddles to the pre-cut fuselage sides. Using a triangle, glue the formers to one side, then glue the second side into place. Attach the elevator to the stabilizer with the provided hinges, and epoxy the tail feathers to the fuselage. Make a hatch, and you're finished! The fuselage can easily be framed up in an evening or two.

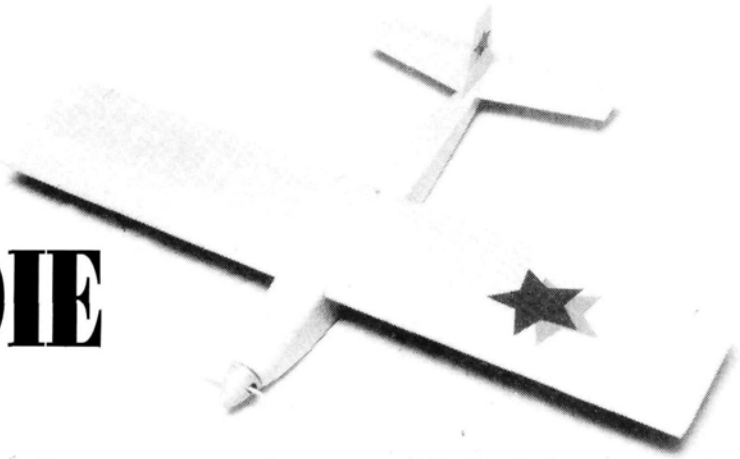
I made one change to the design: I substituted a solid balsa block for the rolled-plywood motor mount. I like the increased strength and rigidity of this modified design. My only other deviation from the instructions was to use aliphatic resin (tan carpenters') glue and T-pins instead of CA for some operations, e.g. wing sheeting, for which positioning the parts takes time.

EDDIE GETS DRESSED

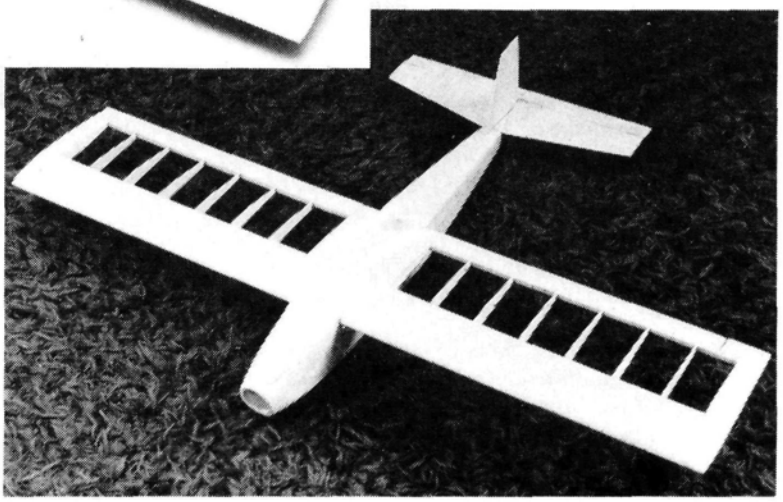
I covered the wing with MonoKote*—yellow on top, blue on the bottom and red and orange for the star markings. I painted the fuselage, tail feathers and spinner with primer, sanded them and gave them two coats of polyurethane spray paint.

Top: The author substituted a solid-balsa block for the rolled 1/32-inch plywood motor mount provided in the kit. The Kyosho 360 ST motor and Sonic-Tronics folding prop are dressed up with a Goldberg spinner. Middle: Midway Models' Fast Eddie kit contains machine-cut and -sanded ribs, pre-cut fin, stabilizer, elevator and fuselage sides; rolled plans; and a complete hardware package. Bottom: Major components laid over plans: built-up balsa wing with ailerons driven by torque tubes; ladder-type fuselage; and solid-sheet fin, stabilizer and elevator.

FAST EDDIE



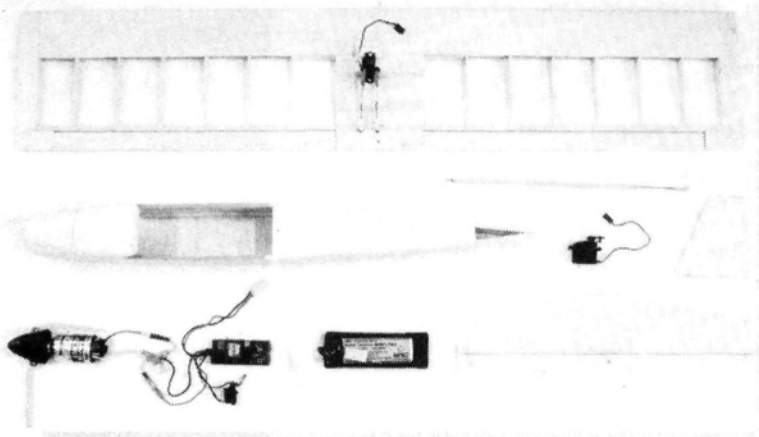
Left: Fast Eddie is quite responsive to control input and performs loops, rolls and Immelman turns with ease. Below: The 37-inch-wingspan Fast Eddie ready for covering. It's made of balsa throughout, except for birch-ply fuselage formers and wing hold-down plate.



EDDIE'S A BUNDLE OF ENERGY!

Designed to use an inexpensive 05 ferrite magnet motor, this model can also take a cobalt 035 or 05, as it did in its speed-record trials. A variable-speed motor control is also required. You can't just switch on the motor and let 'er rip until the battery runs down, or use only a simple on/off motor controller. You'll need motor-speed control to enjoy this plane.

My model carries a Kyosho* 360 ST plain bushing motor driving a Sonic-Tronics* 8x4 folding prop. The prop is mounted on a Goldberg* model 682 prop mount hub and a 2½-inch spinner that's trimmed to clear the folding prop hub. (Some photos were taken with a fixed nylon propeller.) The motor battery is a 6-cell, Sanyo* SCR 900mAh red pack.



Major components ready for assembly. Also shown are a 360 ST motor; a folding prop; an MCR-4A motor control receiver; two S-133 microservos, and a 6-cell motor battery pack.

You'll need a 3-channel radio with two small servos. My receiver is a Futaba* MCR-4A 4-channel unit that incorporates variable motor speed control and receiver battery eliminator circuitry. I used Futaba S-133 microservos for ailerons and elevator. (There's no rudder on this model.)

When I shifted the motor battery slightly, the model balanced at the specified center of gravity. Its ready-to fly-weight was 31½ ounces, for a wing loading of 16 ounces per square foot. The old glider pilot in me wanted to make an unpowered test glide, but I was afraid a hand toss wouldn't develop sufficient air speed, so test-flying was done at full power.

EDDIE'S FIRST STEPS

The plane's first flight was lovely! After a vigorous straight-out hand toss at full power, it climbed immediately. The first turn was smooth, and the model was still climbing. With three or four clicks of nose-down trim, the Fast Eddie was able to hold its altitude at half-throttle. I flew an oval race-track pattern until the motor quit; then I maintained heading and let the model land where it wanted to. This airplane has a fairly fast, reasonably flat glide. I thought the batteries were discharged, but it turned out that power had been cut by the MCR-4A receiver to protect itself from overheating. I had neglected to provide for cooling.

The second flight included left and right turns. Unfortu-

(Continued on page 116)

QUIET FLIGHT

Sophisticated Lady...the project continues...

by JOHN LUPPERGER

PHOTOS BY JOHN LUPPERGER

The completed Project Sophisticated Lady retains its original lines, but sports a stronger airframe.

EXCITING THINGS will happen in the '90s! The Selig-Donovan wind-tunnel results are available, and I bet we'll see many new designs based on these findings. Batteries and motors are taking electric flight to new heights; there are new kits of the extremely popular scale gliders and power scale slopers; and radios are becoming capable of controlling models in ways we only dreamed of a few years ago. Best of all, these new products are of a higher quality than ever before, and this means dependability and safer flying. This makes us more popular with the "general public" and makes our flying more enjoyable!

PROJECT SOPHISTICATED LADY

If you're following the project, remember that you don't have to make every modification; just do the ones you can confidently complete without a hassle, and let the rest go.

When preparing to build the wing, first separate each rib into two pieces. Use the spar notch as a guide, and cut each rib to allow the full-depth spar assembly to go from top to bottom. Mark each separated front portion with the correct rib number so you don't mix them up during construction. When making the ribs that have material removed for dihedral braces, use one that has only a 1/4-inch cutout as a cutting guide, so you won't have to fill them with scrap material later. I didn't do this, and making 1/16-inch fills was a real pain!

You'll need some additional wood for the modifications:

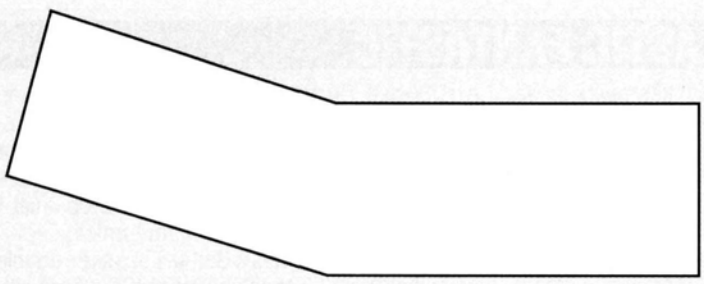
- two pieces of 1/8x1/4x48-inch spruce for the center section spars
- two 1/8x1/4x36-inch pieces for the tip spars
- one piece of 1/4x3- or 4-inch sheet balsa for the shear webs
- one 6x12-inch piece of 1/32-inch plywood for the dihedral braces
- and a piece of 3/4-inch trailing-edge stock for the spoilers.

Any other pieces of wood you need can probably be found in your scrap box.

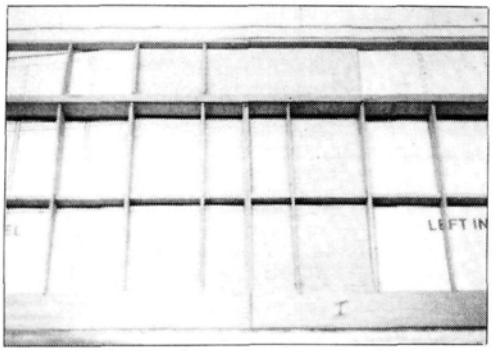
Lay the 48-inch pieces of spruce over the plan and cut off one end so that the spars will span the entire center section of the wing (right and left panels). The center section will be built flat, so eliminating the need for dihedral braces. Cut enough vertical-grain shear webs (17/32 inch thick) to go the full span of the wing. For optimum strength, glue the shear webs to the bottom spar with white or aliphatic resin glue. Be sure to cover the surface of the shear-web end grain thoroughly to allow for glue absorption. Apply glue to the upper surface of the shear webs and place the top spar into position. Weight or clamp it until it's dry, wiping the excess glue off the assembly's outer surface.

Cut the tip spars to length, and glue shear webs to the bottom spar. Weight or clamp, *but do not glue*, the upper spar into place. After the glue has dried, make a mark on the tip shear web 7/16 inch up from the bottom spar. Draw a line to this mark from the top of the tip-root shear web. Sand to the line with a T-bar sander to get the proper taper for the tip. Using the upper spar for proper height, check the taper with the ribs before gluing the top spar into place.

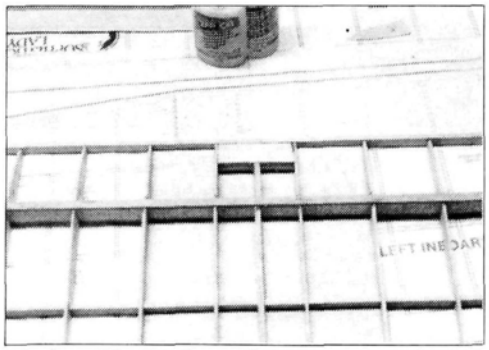
To build the center section for both panels, follow the directions given in the construction manual, excluding the dihedral braces. Build the tip panels in the same way. Be sure to make a good glue



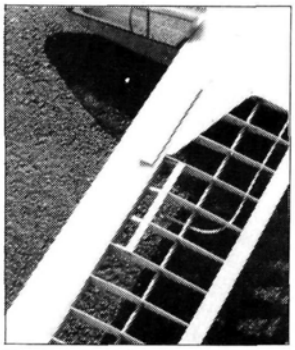
New dihedral brace for tip section of Project Sophisticated Lady. The new dihedral angle raises the wing tip 5 inches above the work surface.



The full-depth sheared-spar assembly. Front halves of right panel ribs haven't been glued into place yet.



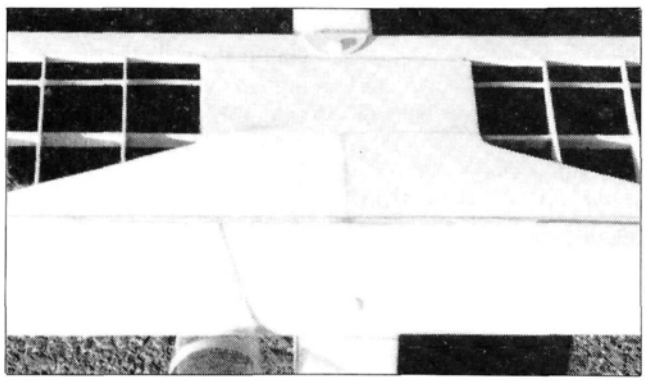
The front block in front of the two center ribs will prevent the wing hold-down bolt from crushing the sheeting when you attach the wing to the fuselage.



Spoilers are the standard flip-up type found in many kits. Cable guides run out through the center bottom sheeting.

joint when you attach the front and rear halves of the ribs to the full-depth spar assembly. When it's time to set the tip dihedral, prop the center section up 2 1/2 inches on the edge of the building board and sand the leading edge, spars and trailing edge vertical. Do the same to the tip, and cut two 1/32-inch dihedral braces to the drawing on the previous page. Prop the tip up 5 inches (with the center section lying flat), epoxy the dihedral braces to both sides of the spar, clamp and allow to dry. Build the opposing panels and join them in the same way.

Cut 1 inch from the front of the no. 1 ribs, or fill in both sides with a piece of block balsa and sand to the rib contour. This block will prevent the sheeting from being crushed when the front wing bolt is tightened. Sheet the leading edge right over the block, but hold off on the center section aft of the spar. Rather than go through a detailed description of the spoilers, I suggest that you get a set of plans for a glider with trailing-edge stock spoilers (e.g. an Oly II or Sagitta) and follow its construction sequence.



Front and rear wing hold-down bolts attach the wing securely to the fuselage. Plywood plate in the back helps to strengthen the trailing edge where a bolt hole is drilled.

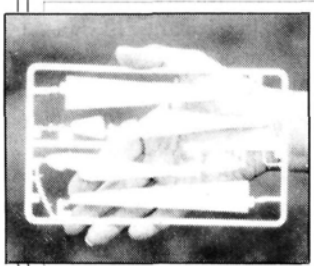
Run the tubes for the spoiler cables back to the center and out through the bottom sheeting just behind the spar. Leave about 1 1/2 inches of tubing sticking out to guide the dial cord toward the front of the fuselage. Sheet the rest of the center section and sand the entire wing. Cut a half-circle of scrap 1/32-inch or 1/16-inch plywood. This piece will protect the trailing edge from being crushed when the rear wing bolt is tightened.

Center the wing on the fuselage and drill the front and rear bolt holes through the wing and the hold-down blocks in the fuselage. With the wing still in place, cap the holes for 10-32 bolts. Because of these modifications, it won't be necessary to apply glass-cloth to the center or to the poly joints, as in the instructions.

You now have a 2-meter ship that can be launched safely on a 12V winch and will withstand the rigors of the learning process better. I hope you enjoyed this project. If you want to see similar material, let me know.

SLOPER OR ELECTRIC?

I recently met Mark Allen, the designer of the Falcon 880. He was in Southern California for a weekend, and, through my friend Bill



The Bocian plastic kit from Poland. Six models are available from Squadron.

PLASTIC FANTASTIC

No, not the kind of scale glider kits you're thinking of—*plastic* ones! Squadron*, a company well-known for its mail-order books, also has a division devoted to plastic modeling. Their catalogue costs $3.50 and includes every type of model imaginable!

A series of 1/72-scale Polish glider kits caught my eye (I think they're actually smaller—about 1/100-scale). I didn't know they made plastic kits in Poland, but these little babies are gems. Most of the full-size ships have names I've never heard of, e.g., Bocian, Gil, Sep, Mucha, Jantar Standard and Zefir 2A. The kits cost only $2.50 and are occasionally on sale for $1.99, but they have quite a lot of details, including clear canopies. They would look great on top of a trophy, or you could do what I plan to do—make a mobile for your office!

Squadron also offers a German 1/72-scale double kit of the Grunau 9 and Schulgleiter SG 38 primary gliders for $13.95. This kit includes the fuselage pods for you to build two versions of each ship! Good things *do* come in small packages!

8TH ANNUAL ELECTRIC R/C FLY-IN

The Boeing Hawks/Puget Sound Electric Model Flyers will host its 8th Annual Electric R/C Fly-In on June 23 and 24. There will be prizes and trophies for Most Aerobatic, Longest Flight, Best Scale, Most Impressive, Special Achievement, Best Multi-Motor and Class A Sailplane Battery Allotment. The event will take place at the Boeing Kent Space Center Field, South 196th St. & 68th Ave., Kent, WA, and the entry fee is $5 per day. For more information, call CD Bernard Cawley at (206) 839-9157, or Assistant CD Ben Almojuela at (206) 283-3407.

1990 MID-AMERICA NATIONALS

The 64th AMA Nationals will take place July 14 through 22 at the Mid-America Air Center, which is located between Lawrenceville, IL, and Vincennes, IN. The F3B will be held on Monday, July 16, Hand-Launch R/C on Tuesday the 17th, 2-Meter on Wednesday the 18th, Standard on Thursday the 19th and Unlimited on Friday the 20th. Scale Sailplane will be held on Monday the 16th, and the new scale rules will apply (this is no longer a thermal-duration event.) According to the schedule I received, it doesn't look as though there will be a cross-country event. For more information, contact the Academy of Model Aeronautics.

TOMCATS ELECTRIC R/C CARNIVAL

On June 16, the Santa Clara County Model Airplane Skypark will be the site of the 1st annual Tomcats Electric R/C Carnival. All electric aircraft are welcome. Power aircraft will have the use of a 65x500-foot paved runway, and there will be a concession stand on-site. Prizes will be awarded for: Pilots' Choice, Most Innovative, Best Flying Dome, Best Finish, Most Spectacular Crash, Best Multi-Motor, Largest Aircraft, Smallest Aircraft, Longest Distance Travelled and an All-Up/Last-Down event. For more information, call Brian Nelson (408) 629-2827.

Forrey, we got together to do some electric flying.

Like many other glider-guiders, Mark has been bitten by the electric bug. He designed a hot little V-tailed sloper known as the "Isis," and he calls his battery-powered version the "Electra Swift"—an apt name. This model uses the Selig 3014 airfoil (the same fuselage and foam-cores as the Isis) on aileron, elevator and motor on/off. I think its flying weight is approximately 36 ounces. It's powered by an old-style, 7-turn, Astro 05 (with smaller brushes and commutator), on seven SR 1250mAh cells turning a Graupner 6x6 or 7x3. (Mark tried a Graupner 8x4.5, but it exhausted the batteries too quickly.)

I flew the Electra Swift several times and was really impressed with its performance. This model is equally good at thermalling, high-speed flight and aerobatics. The Electra Swift would be a good, high-performance thermal model for competition fliers. I think it would also be competitive in the F3E sportsman class, and it would make a good sport power model for sport fliers with aileron experience. The model's only drawback is its extremely small fuselage. Mark will work on a fuselage shape that will accept 900 and, he hopes, 1200mAh battery packs. If that model goes into kit production, I'll be sure to let you know.

INTERNATIONAL SOARING R/C SCALE FUN FLY

Don't miss the 1990 Scale Fun Fly! There's talk that Wil Byers and company may take a year off after this year's event (alternating every other year with Southern California's Torrey Pines Gulls). If you're interested in scale gliders or power scale slopers (PSS), make your way to the Tri-Cities area of Washington on May 25, 26 and 27. For more information, contact Tri-City Soarers*.

Mark Allen with his original-design sport electric—Electric Swift. Even with an older-style Astro 7-turn 05, it's a fast, agile performer.

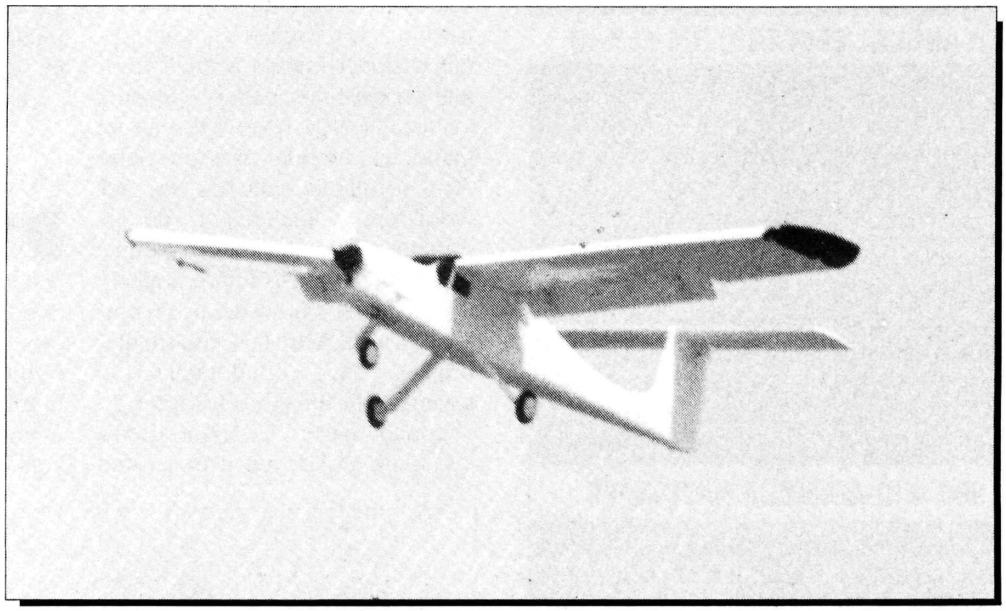
In the next issue, I'll have some shots of the finished Project Sophisticated Lady and a report on the IMS show. Till next time...good thermals and a full charge!

**Here are the addresses of the companies mentioned in this article:*
Tri-City Soarers, *632 Meadows Drive East, Richland, WA 99352, or call (509) 627-5224, or (509) 525-7066.*
Squadron Mail Order, *1115 Crowley Dr., Carrollton, TX 75011-5010.* ■

NASA "SAFE WING"

by A.G. "ANDY" LENNON

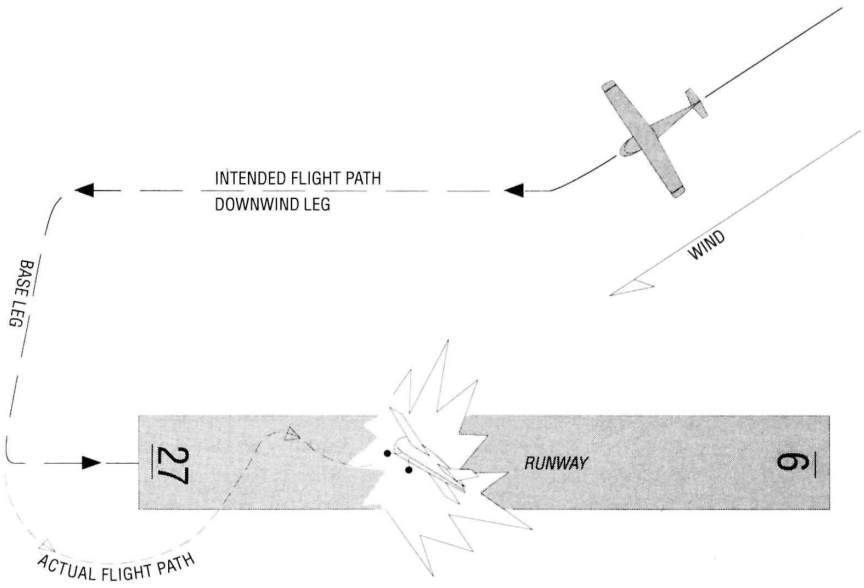
- **Full-scale stall/spin-**
- **prevention methods**
- **applied to models...**
- **it works!!**



HERE'S A GRIM STATISTIC: Roughly 30 percent of all fatal accidents involving light, full-scale airplanes are caused by stalling and spinning at low altitudes, and ground impact occurs before the spin fully develops. Several members of my club have discovered that R/C model aircraft are also prone to this insidious failure. What's happening?

As a private pilot, I've been interested in wing modifications that will improve the stall/spin characteristics of both full-scale and R/C model airplanes. Most modelers know that a model's wing lift is proportional to the square of its air speed. At the same angle of attack, doubling the speed increases lift fourfold. Also, lift varies directly with the angle of attack, from the airfoil's zero lift angle to its stalling angle. In high-speed flight, the wing operates at a low angle of attack; at low speed, that angle must be increased to maintain level flight. The stalling angle of the wing's airfoil determines the lowest speed limit.

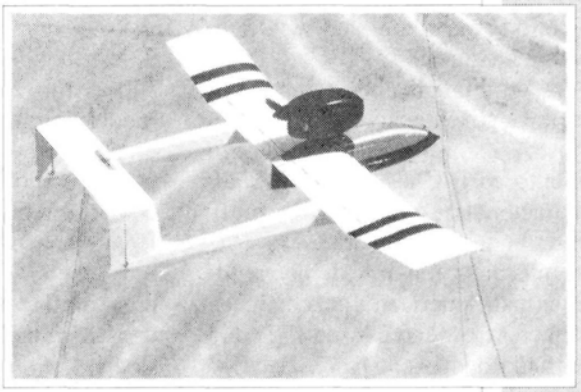
Centrifugal force plays a significant part in stalls and spins because it increases the weight that the wing must support. It's encountered when banking steeply, sharply pulling up into climbs, and when you panic and use full-up elevator when pulling out of dives at low altitude.



Classic stall/spin flight path, frequently fatal. Wrong way to "hit" the runway.

The Osprey, powered by a .45 diesel, about to start its takeoff run. The leading-edge droop shows clearly.

The Sea Loon in its natural element—water. The leading-edge droop starts at the inner-wing stripe.



For example, a full-scale Cessna 172 at gross weight stalls at 57mph. In a 60-degree banked turn, its stall speed increases by 42 percent to 81mph, and this is due entirely to the extra load imposed by centrifugal force. As a normal wing approaches the stalling angle, aileron-control effectiveness deteriorates markedly. Lowering an aileron to introduce a roll input at this angle increases the wing's angle of attack at that aileron, and may cause it to stall—just the opposite of the action commanded by the pilot.

A TRAGIC SCENE

Suppose an inexperienced pilot is flying a high-wing aircraft. He's in a left-hand pattern for landing at a busy airport, and a light crosswind is blowing from left to right. After turning onto the base leg of his approach, he slows the airplane by throttling back and increasing its angle of attack by applying up-elevator. While scanning the area for other traffic, he lowers the flaps, trims the aircraft and announces his intention to land.

At an altitude of 300 feet, he turns left again onto final approach, and our inexperienced aviator finds that the crosswind has made the plane drift well to the right of the center line. To correct, he cranks in more left aileron to steepen his bank, and he adds up-elevator to accelerate his turn; both increase the centrifugal load. As the aircraft is realigned with the runway, the pilot applies heavy, right aileron to straighten up. The down-aileron (left) wing stalls, and over he goes to the left as the plane starts to spin. Unable to recover at this altitude, he becomes another statistic.

In an attempt to remedy the spin/stall syndrome, a variety of wing modifications were tested by aeronautical engineers: fixed or retractable leading-edge slots; wing washout to reduce tip angles; greater camber at the wingtips and slot-lip ailerons. While modifications did improve stall behavior, they also aggravated spin characteristics. Many of these changes worsened aircraft performance and increased the complexity and cost of construction and maintenance.

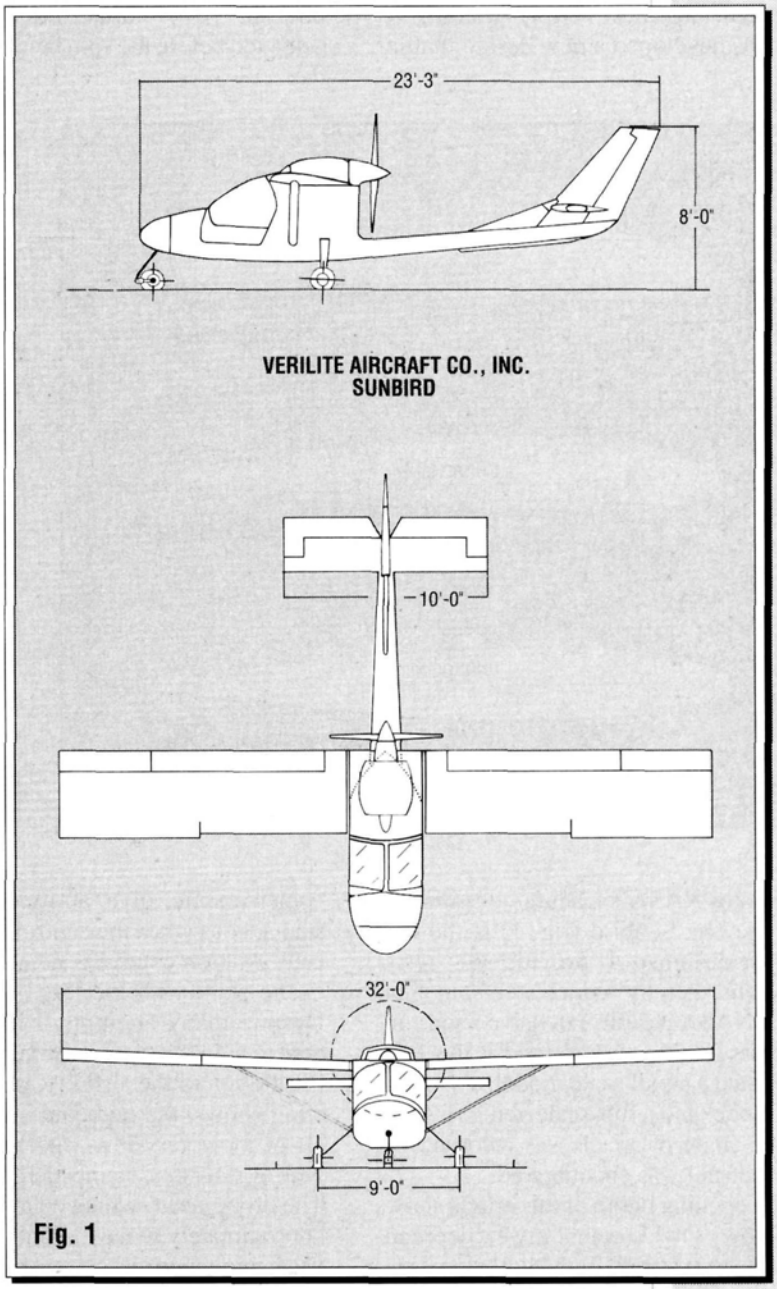


Fig. 1

NASA'S SOLUTION

In the late '70s, NASA's Ames Research Center initiated a program to develop an improved leading edge that would be inexpensive to manufacture and would require no maintenance.

After determining the best wing modification through extensive wind-tunnel tests, NASA incorporated these design changes into an R/C scale model. Stall/spin characteristics were significantly improved, and, to confirm these R/C model results, four, full-scale light aircraft from Grumman American Yankee, Beech Sierra, Piper Arrow and Cessna 172 were modified and flown extensively. Because manufacturers pay such high insurance premiums, they're building fewer, full-scale light airplanes. Verilite Aircraft Co., Inc., has developed a new design that incorporates NASA's leading-edge modifications. The Sunbird (fig. 1) is the first aircraft designed to provide spin resistance and thereby reduce stall/spin accidents. NASA has run extensive wind-tunnel tests on this aircraft, and it has built and tested a small scale model, a 1/4-scale R/C model and a full-scale version. A 28-degree angle of attack was recorded before the stall was encountered.

The opening photo of this article shows the Snowy Owl I (one of my earlier models) in slow-speed flight with flaps extended. The increasing leading-edge droop ahead of the ailerons is clearly visible, and it reached its maximum at the wingtips. This modification succeeded in delaying the stall, but the ailerons proved ineffective in the attitude shown.

NASA's leading-edge droop has been successfully incorporated into four R/C model aircraft: the .15-powered Sparrowhawk; the .40-powered Snowy Owl II; the .15-powered Sea Loon (a flying boat); and the Osprey, which is a .45-powered craft designed to be used with both wheels and floats.

While the smaller models can be *forced* to spin, only one or two turns are achieved before the spin becomes a spiral dive, and recovery is instantaneous when the controls are neutralized. Aileron control is greatly improved in the stall, with the flaps up or down. Despite many attempts, I haven't been able to spin the two larger models. As the illustration of the airflow over the NASA wing shows, the outboard, drooped panels become very low-aspect-ratio wings, with a stall that's considerably delayed. The droop itself, which delays the stall to approximately twice the stall angle of the basic wing, permits effective aileron control at the higher angles of attack.

If you fly models with flat-bottom or semisymmetrical airfoils, you could modify the wings by adding droop. (See the cross-hatched areas in figs. 2A and B). For evaluation purposes, I've done this by using Styrofoam, which is held in place with transparent tape.

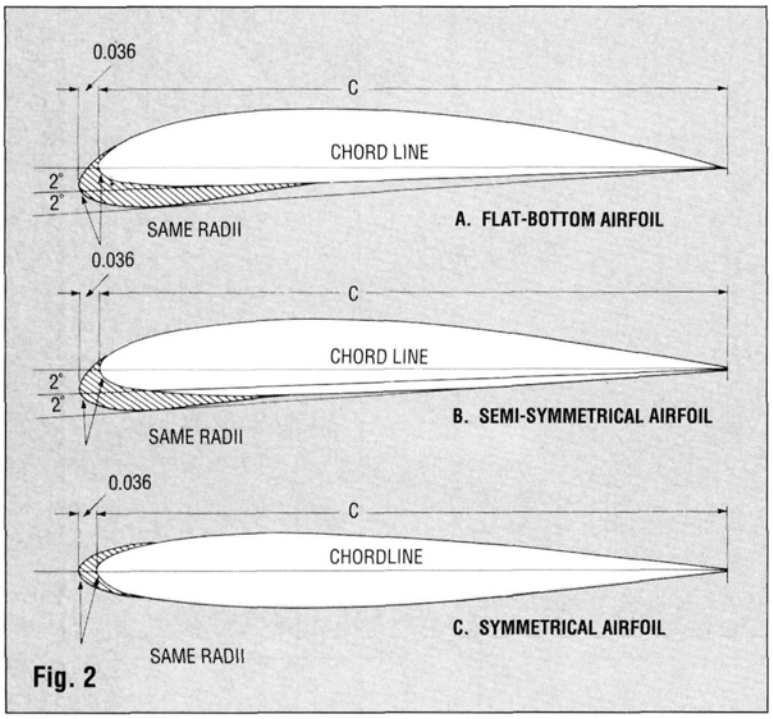
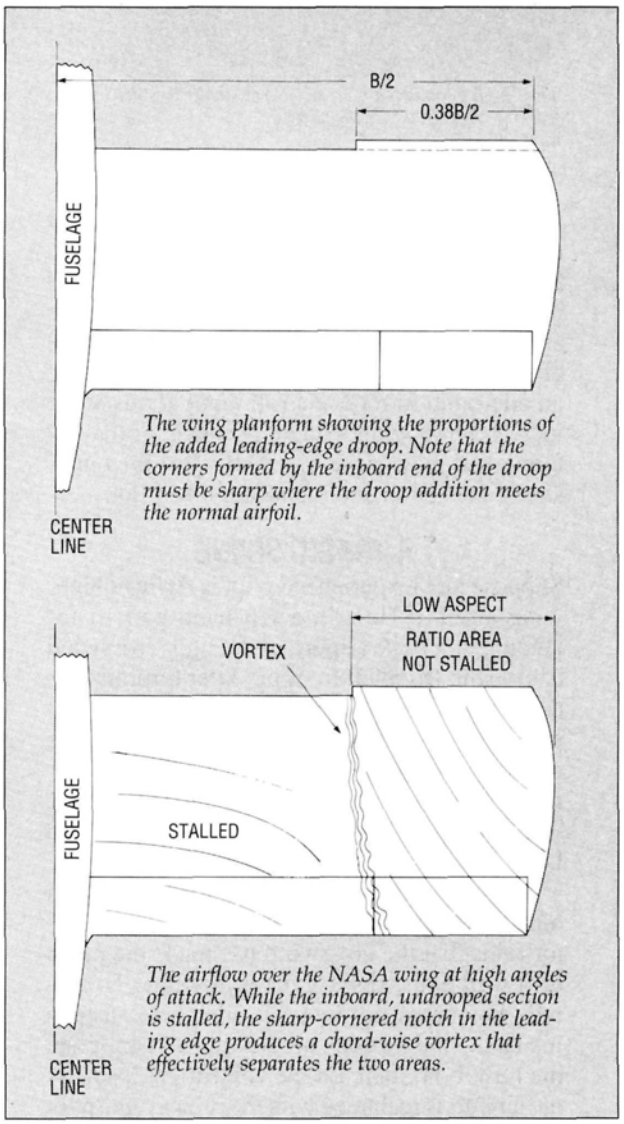


Fig. 2



The wing planform showing the proportions of the added leading-edge droop. Note that the corners formed by the inboard end of the droop must be sharp where the droop addition meets the normal airfoil.

The airflow over the NASA wing at high angles of attack. While the inboard, undrooped section is stalled, the sharp-cornered notch in the leading edge produces a chord-wise vortex that effectively separates the two areas.

As an alternative, you could add balsa ribs like the ones shown in the cross-hatched section, and a light leading-edge spar. Cover them with bond paper or thin balsa, and glue this unit to the outboard wing leading edge. I haven't tried this droop on symmetrical airfoiled wings, but it might delay the stall in both upright and inverted flight (see fig. 2 C).

Congratulations, NASA, for your major contribution to aviation safety. I hope this "safe" wing will be incorporated in future aircraft designs. ■

NORTHERN CALIFORNIA'S BIG, BEAUTIFUL BASH

Chuck Fuller's Jungmann flies by inverted and blowing smoke.

MERWIN RANCH GIANT-SCALE FUN FLY

by JOHN SULLIVAN

I'D NEVER BEEN to a Merwin Ranch Giant-Scale Fun Fly before. Some modelers think that, like a homing pigeon, you'll instinctively know how to get there. Their directions are somewhat vague: "Just turn right onto Jefferson off I-80 and drive until you see the planes." Some are kind enough to add, "It's quite a ways out there." "Quite a ways" is exactly 17.1 miles. The two-lane blacktop road veers south away from Sacramento and into California's Delta country. It seems

Above: Larry Bennett with his striking Sig Spacewalker. Below left: AT-6 Texan and Bucker Jungmann are only two of Chuck Fuller's giant-scale stable.

PHOTOS BY JOHN SULLIVAN

MERWIN FUN FLY

Tony Kussavag throttles back his Saito 120-powered Ryan PT-22 for a perfect touchdown on the mains.

Dwight Cathcart with his glass and foam Saxton Corsair. The 24-pound warbird flew behind a Zenoah G62 with an Airtronics PCM7 for guidance.

as if every road is 25 miles long with no intersections! Everything in the Delta is big: fields of tomatoes stretch as far as the eye can see, huge combines straddle the road, and magnificent ranch houses with giant shade trees loom ahead and then disappear in the rear-view mirror.

Your thoughts drift to images of airdromes with corrugated tin hangars, hay bales lined up along a runway, and Stearmans tied down near a red gas pump. Then, suddenly—yipes! You hit the brakes and back up to the cardboard sign that says "Fun Fly." Make a right turn and you'll see specks flying way off in the sky. Farther up the road, there's a gravel entrance choked with tractors, trucks, RVs, cars, people with orange vests and an occasional motorcycle.

GIANT-SCALE HEAVEN

What's going on here? Had I just driven into IMAA land—or was this giant-scale heaven? Two 1/4-mile-long rows of mobile homes, cars trailers and big birds sprawled before me. This was CD Ken Runestrand's and the Chapter 1 IMAA Eagle Squadron's way of saying thanks to all of the other IMAA Chapters for the meets they hold every year.

The Merwin Meet has been held on Labor Day weekend for 11 consecutive years (that's about to change, but more on that later). None of this would be possible without the blessing of Mr. Merwin, on whose land the meet is held. He doesn't fly R/C; he just loves to see those big birds. Each year, the Eagle Squadron sets up a sun shade, tables and comfortable chairs so that Mr. Merwin can watch three days of the best giant-scale flying anywhere.

Black Baron Presto finish on Bob Francis' Curtiss Wright 21 looks like the real thing!

SEEDY SITE

The flying site is a story in itself. It's a seed farm that stretches out till the horizon blurs. Giant vacuum cleaners suck up the seeds, and this leaves immense fields of close-cropped grass that resemble a golf course in need of a little attention—just perfect for a big 6-inch rubber wheel banging up and down on an oleo strut (or a bungee restraint strut) until takeoff, when everything sags or folds up into the wings.

The quality of the planes was exceptional. A few years ago, when giant scale was emerging, modelers were sometimes hard-pressed to fill all the new-found space. Today, that's not a problem: tape and stitches, panel lines and rivets, handholds, navlights, steps, rigging, louvers and scale hardware abound.

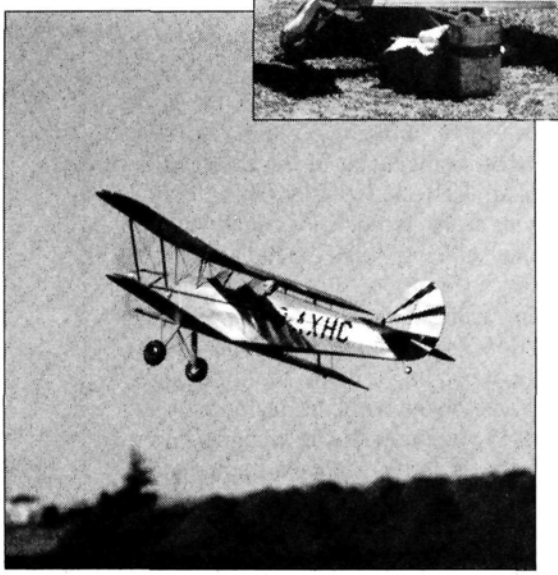
At a meet of this size, it's possible to

find propeller-driven aircraft in every stage of development. True, you'll find an occasional giant Stik or Robin Hood here, but most planes are scale—everything from Pietenpol Air Campers to Corsairs and fire-breathing Lasers.

Frequency control was handled with a put-and-take honor system, which I won't attempt to describe here, but it kept a lot of planes in the air. You could fly till you were blue in the face, or you could buy a hamburger from the world's largest lunch wagon and sit on the sidelines and watch. All the flying was great, and there was something for everyone, whether it was a Volksplane picking its way between air bubbles or a Corsair flat out and coming up a Mustang's tail on a mock strafing run with everybody yelling, "He got 'em! He got 'em!"

It's a real pleasure to cover a meet that's structured like a fun fly. None of the frantic elements induced by competition is present. If you ask a question about split flaps on a warbird, its owner might remove the wing just to show you the intricate installation. It's wonderful to be able to exhibit pride in your aircraft and heap well-deserved praise on others.

CD Ken Runestrand never left the flight line. Here, he checks out Harold Kohler's scratch-built Turbo Ag Cat (Dane Andes holds). Weight, 26 pounds; MonoKote and paint finish.



Manny Casquilho's Stampe banks right on takeoff. Extremely realistic craft.

One of five flight lines at the Merwin Meet. Put-and-take frequency system kept planes in the air from dawn to dusk.

The absence of competitive frenzy seemed to help performance and improved reliability. I watched one complex machine after another roll up to the flight line and start with one flip after priming. Throughout the meet, Ken Runestrand was on the flight line performing his CD duties, and he made everyone feel at home.

Too soon, it was time to leave, and I'm sorry to say, my first Merwin Meet was my last. The seed crop is no longer a viable enterprise for the Merwins, and they're going to plant something different. Don't despair; Ken Runestrand says that they've moved to Crow's Landing (the site for the Modesto IMAA group), and the event will still be held during the Labor Day weekend.

It's sad to see the Merwin era end, but as a giant-scale extravaganza, Crow's Landing will, no doubt, rank right up there with Las Vegas and Sepulveda. I won't even *attempt* to give you directions to this new site, but you can contact IMAA District Director Budd Crane* for that information. My guess is he'll tell you to just drive south on I-99 until you see the planes. It's probably "quite a ways out there," but something tells me it will be worth the drive.

Here's the address that's pertinent to this article:* ***Budd Crane, IMAA District X Director**, 453 Maple St., Livermore, CA 94550, (415) 447- 2158.* ■

THE

MECHANICS OF LANDING GEAR

MUSIC WIRE VS. SHEET METAL-BOTH SIDES OF THE COIN

by JIM STOCKE

LANDING-GEAR MECHANICS are one of the most misunderstood aspects of R/C airplane design. During my 20 years in the hobby, I've seen landing gear ripped from fuselages countless times; modelers repair them, only to have them ripped out again on the next hard landing. Apparently, there's a lack of understanding about just what we're asking these legs to do.

Whether the aircraft is a tail-dragger or has tricycle gear, most of the trouble is with the main gear. The nose wheel is less susceptible to problems, so I'll confine my discussion to the main gear, of which there are two types: music wire and aluminum. (Retracts have wire legs and a metal or hard-plastic mount, so they're a combination of wire and aluminum, but they closely resemble aluminum in their mechanical behavior when landing.)

My first R/C airplane was the Goldberg Senior Falcon, which I built in 1967. Its main gear and nosegear were made of 5/32-inch-diameter wire. The main gear used the torsion-bar principle, which I thought very clever at the time (and still do). During landing or takeoff, the gear flexes in two directions. The part of the wire that's embedded in the fuselage is tortionally deflected (twisted). In addition, the wire is also deflected vertically along the exposed length that extends from the fuselage. (Figure 1 shows this type of landing gear; Figure 2 shows how this gear flexes on landing.) As long as the degree of bending is below the yield point of the steel in the wire, the gear retains its shape. We all know that in practice, however, the gear tends to lean somewhat rearward after several landings (depending on how smooth they were). We also know that on a less-than-perfect landing, the gear could flex and bend until the fuselage literally touches the ground. The gear would, of course, take a new, static position, but it could be bent back to its original shape, and, if we're lucky, there won't be any damage to the airplane.

I've had many less-than-perfect landings, but I've never ripped the gear from an airplane equipped with wire landing gear. On a low-wing airplane, I've bent wing-mounted gear far enough backward to push the wheels into the wing's bottom covering and, once, even through the top!

Enter the aluminum landing gear, which mounts rigidly to the bottom of the fuselage, as shown in Figure 3. These gear readily flex vertically, but not longitudinally. On a hard landing, they rely on strength to prevent gear-mount breakage. The problem is this: on a hard landing, the impact exerts high forces on the landing-gear system. The forces build up rapidly in longitudinal and vertical directions, es-

FIGURE 1

TORSIONAL-TYPE WIRE GEAR MOUNTED IN BOTTOM OF FUSELAGE

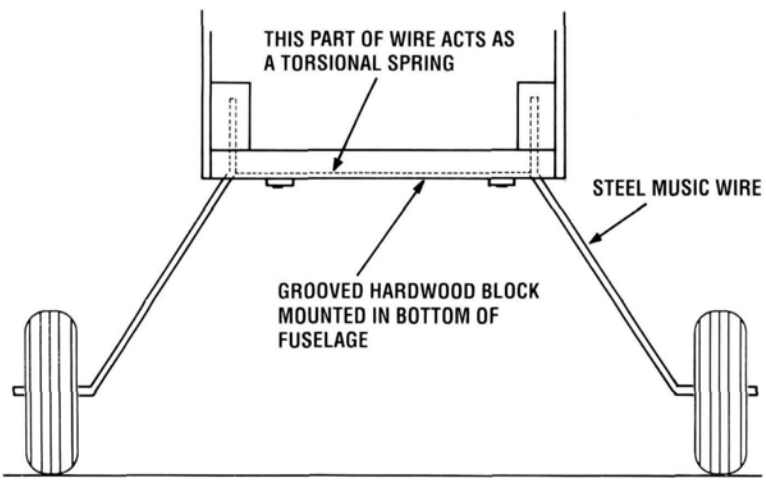


FIGURE 2

SIDE VIEW OF FUSELAGE-MOUNTED WIRE GEAR

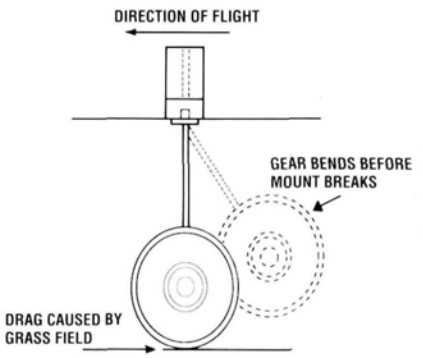


FIGURE 3

FUSELAGE-MOUNTED ALUMINUM LANDING GEAR

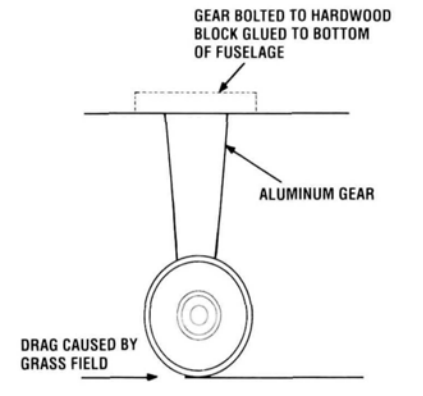
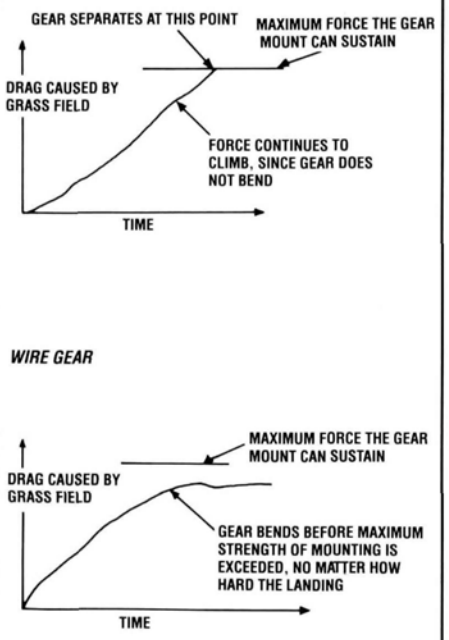


FIGURE 4

FORCE IMPULSE COMPARISON: ALUMINUM AND WIRE GEAR IN A HARD LANDING



pecially on grass fields. Sometimes, the the mount, which is weaker than the gear itself, can't resist these forces and rips out the bottom of the fuselage.

This isn't true of wire gears. The forces build up rapidly, but only to a point where the gear begins to bend and twist. In other words, the maximum force the landing-gear mount sees is equal to the force necessary to bend the gear out of the way. This usually isn't enough to break the mount. Figure 4 shows a force/time diagram that illustrates this principle using both wire and aluminum gear assemblies.

I've seen millions (well, maybe hundreds...or would you believe dozens?) of aluminum gear fail at the mount. A few years ago, at Byron's "Striking Back," at least 70 percent of the gear broke on landing during very gusty conditions—honest: 70 percent. Most of these were retracts that appeared to have a shear pin to protect the mount and the gear, but several didn't, and the results were what you'd expect. This experience clearly showed the problems of a mount-rigidly-and-try-again approach, which, of course, always adds weight.

I watched a friend rip the gear off a Byron Glasair three times. After each disaster, he reinforced the mount, only to have it fail again. I saw his plane for sale in the local hobby shop with its gear reinforced beyond your wildest dreams. I bet the gear will be ripped out again—and take a large portion of the fuselage with it. When I try to explain to my flying buddies what the mechanics of the system are, most simply don't believe me. Rejection of my explanation has been unanimous, and I don't understand why. Some R/Cers even haughtily proclaim that they *never* have hard landings. Well, I bet they don't fly very much; unless you're a Chip Hyde, you have a hard landing once in a while.

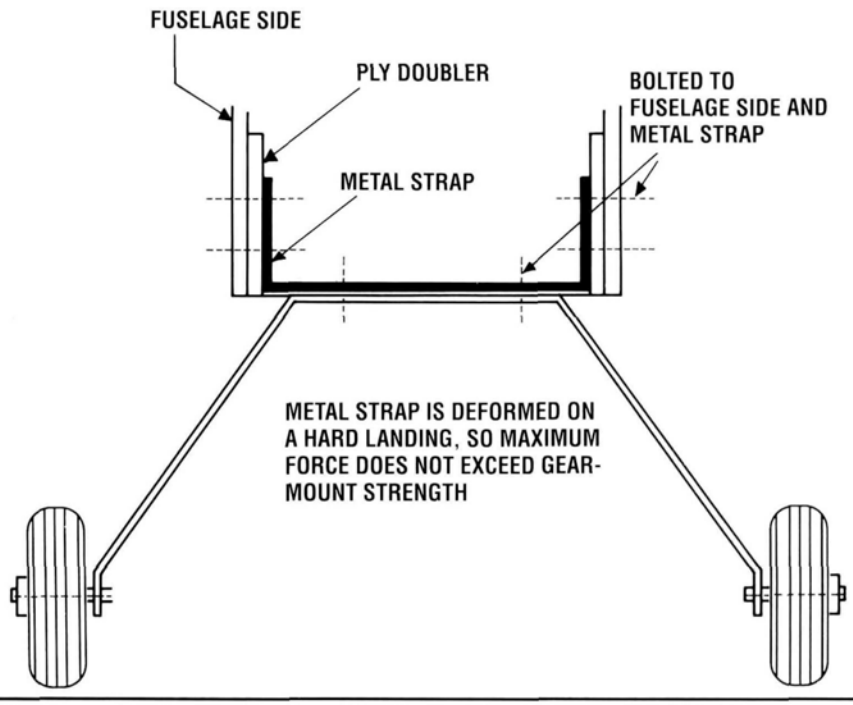
Lest the makers of aluminum gear string me up from the highest tree, I must make a few very important points. The strength-to-size ratio is very favorable in planes up to approximately 5 or 6 pounds (and this covers the majority of craft flown). Smaller planes can survive most hard landings with their aluminum gear intact, but gear on the larger planes have problems. The strength-to-size ratio is less favorable, and you see many gear failures on these larger airplanes.

So, what to do? After I broke the gear on my 1/3-scale Rousch Laser for the second time, I mounted it on a brass plate, which bends enough to reduce the force below the "rip-out level." (Figure 5 shows this design.) Since I installed the plate, the gear on my Laser hasn't broken, even though I've had a few rough landings.

This plate design truly absorbs energy by bending the plate to which the gear is mounted, rather than transferring high-impact loads directly to the structure (as is the case with gear mounted directly to the plane). When the plate is bent, though, you must remove it and re-bend or replace it, but this sure beats repairing a ripped-out mount. The plate shouldn't be too heavy, or the forces will overcome the strength of the mount. The Laser weighed 16 pounds, and the brass plate was only 1/16 inch thick. Smaller aircraft should probably have an aluminum plate that's approximately 1/64 inch thick, or even thinner. Some experimentation is necessary here. Start with a very thin plate, because you've nothing to lose if the plate bends too much. If you start a plate that's too thick, you risk breaking your gear mount. It would be even better to apply something like R/C car shock absorbers to landing-gear systems. These shocks are real energy absorbers, and I can visualize beautifully smooth landings with proper use of them in R/C landing-gear design. Wire gear store landing energy because they're springs, and this is what makes for a bouncy landing...well, better bouncy than broken! ■

FIGURE 5

SHOCK-ABSORBENT, FUSELAGE-MOUNTED ALUMINUM LANDING GEAR



JAVELIN

(Continued from page 24)

simplicity of structure and a minimum parts count, and since every part contributes directly to the Javelin's strength, light balsa would actually be detrimental. Don't be tempted to add reinforcements to increase crash resistance, because they will be of little help in such cases and will add weight!

Some of the construction is a little unusual, so I'll talk about the differences and leave the straightforward assembly to you.

WING CONSTRUCTION

When constructing the wing, I had three aims: lightness with strength; simplicity; and efficiency. It's all made of 1/16-inch, medium-weight sheet, and it might look frail to you, because it doesn't have normal spars. Rest assured, using the stressed-skin principle, the strength is there (as a variety of applications have proven).

In world-class competitions, we see extreme efforts to produce ultra-precise wing sections, i.e., "molded" wings, etc. (the obvious hope being to reduce turbulence and drag and have more efficient wings). This takes a lot of effort, and the resulting weight isn't good for EP. As for obtaining a smooth contour, a "sheeted" structure comes closer to "molding" than any other traditional method and loses very little in efficiency (a nice feature of the Javelin's wing).

Apart from where mentioned, construction can be right on the plan, and I used

(Continued on page 72)

JAVELIN

(Continued from page 70)

Hot Stuff* CA for all gluing. The Javelin has four panels—two center and two polyhedral—which are joined *before* the top sheeting is installed, and that's added one panel at a time.

Pin the lower leading-edge (LE) and trailing-edge (TE) sheeting for one center panel into place. Note the need for a 3/32-inch shim strip at the leading edge to suit the airfoil's lower shape. Add the full-depth "spar" to the LE sheet. Follow this with the forward rib sections, then add the aft ribs. Be sure the TE of these has a sharp edge so that when the top sheeting is added it will meet the lower sheeting at the aft edge. Repeat for the other center panel. Next, assemble the tip panels in the same way. To ensure that the overlap will be precise, use the center panels as guides when you install the tip spars.

Now join all the panels at the prescribed dihedral angles. At the center joint, add a 1/32-inch ply joiner.

Next, with one center panel pinned to the building board, install the top and center section sheeting. (To ensure sufficient assembly time, use a resin-type glue.) Add the capstrips. Be sure to add the reinforcement for the attachment dowel and mounting screw before sheeting. Now add the LE strip, and when you've done that, repeat for the second center panel.

The polyhedral sections are next. As before, pin one tip section to the board, but this time, you'll need some support for the rest of the wing: a piece of two-by-four aligned under the raised center panel does the trick neatly. Note that the top sheeting extends past the end rib to full span. Install the sheeting and the LE strip, then repeat for the remaining poly panel.

The wing tips are no problem. First produce the outline shape in the top sheeting; then, using a sanding block and the bottom of the tip rib as guides, sand a bevel on the sheeting outline. Add the sheet tip plate to finish.

To complete this assembly, edge-glue the 1/8x1/4 TE to the aft edge of the TE sheeting, then carve and sand the leading edges and the trailing edge to shape. After that, carefully block-sand the entire wing to produce a smooth contour. Finally, install the LE attachment dowel and the 1/32-inch, ply-mounting, screw plate.

EMPENNAGE

Use hard balsa for the rudder's center spar, because the hinge load on this will

(Continued on page 98)

GIANT STEPS

by DICK PHILLIPS

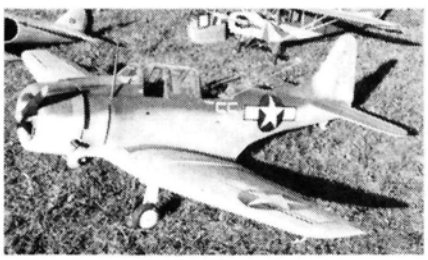
Large-scale racing and some additional trimming tips

Hazel (Sig) Hester at EAA/IMAA Rally at Oshkosh in late 1989. Hazel and Maxey have nearly identical Spacewalkers, which they take to events around the country.

HURRICANE ERROR!

One day last summer, I received information about Clark Airscrew's plans to produce a Hurricane kit, and I also received a photo of a Hurricane built by Ralph Bolitsky of Kitchener, Ontario, Canada. You guessed it; I mixed up the two items and attributed Ralph's photo to Clark Airscrew, and the kit didn't even exist at the time. My apologies to anyone who might have suffered because of my error, and my thanks to Ralph and to John Clark for bringing this mix-up to my attention.

Ralph Bolitsky was a final inspector on the famous deHavilland Mosquito. He held a pilot's license for many years, and he has been building models since he was eight. (Ralph is 72; how many of the people you know have been building for 64 years?) There's a photo of Ralph's Hurricane in *MAN's* October '89 issue. He's an excellent builder, and he told me that the Hurricane is a great flier.



Crash Evanson belongs to the IMAA Chapter 46 Renegades. These are samples of their airplanes at the EAA/IMAA rally. It looks as if they have a pretty fair handle on the building skills required in the hobby.

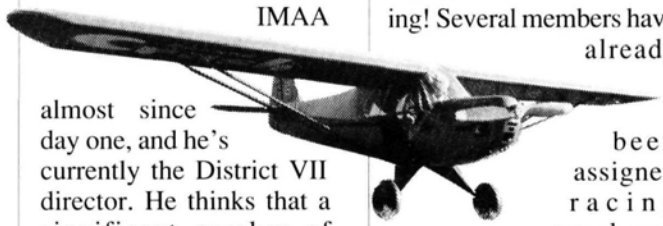
1/2-SCALE PYLON RACING?

Recently, my old friend and IMAA member Crash Evanson* sent me some information. (His nickname is related to his motorcycle experiences—not to those with model planes!) He's very interested in large models, but he also flies electric. Crash has been involved with the IMAA almost since day one, and he's currently the District VII director. He thinks that a significant number of IMAA members are interested in competition. This isn't why the IMAA was founded, but Crash meets a lot more IMAA people these days than I do, so he can better assess the attitude out there.

Crash attended a couple of events at Oshkosh, which has recently included model airplanes. I can't imagine a better place for modelers and full-scale enthusiasts to meet than at the EAA headquarters, and Crash tells me the events held there have been superb. Another meet called the "Rally of Giants" is scheduled for June 28 through July 1.

Crash and a small group of dedicated large-model builders have formed the Half Scale Racing Association, which will sponsor races for 1/2-scale Formula 1 racers. Now, that should be worth seeing! Several members have already been assigned racing numbers, and Crash wants to hear from anyone who's interested in racing big birds. He tells me that a group in California is interested in racing, and it seems that the organization will soon be viable. Racers must be Formula 1, but can you imagine a gaggle of Ziroli Texans polishing pylons in a scale Reno-type race? I can, and it raises the hair on the back of my neck. Crash has also been talking to the Reno Air Race people, and

(Continued on page 123)



Above: This large J-3 belongs to Crash Evanson, and at 1/2-scale, it really qualifies as a biggie. Name painted under the wing says "Orange Crash" in the style of a popular soft drink. No mistaking its owner!

BUILDING

MODEL AIRPLANES

by JOE WAGNER

High-quality lite-ply and fastener facts

AFTER BALSA, plywood is the second most common material for model building, and it's usually composed of one of three types of wood. Lite-ply is made from Italian poplar; luan is what used to be called Philippine mahogany; and aircraft-grade plywood is made of birch. Each variety consists of three to five laminations of essentially blemish-free wood, which are glued together with a waterproof resin.

Bonding 1/64-inch ply to balsa. Put Balsarite on the mating area of the balsa and Quik Stik on the plywood; this makes heat-bonding the two easy, strong and permanent.

In many of today's R/C model kits, lite-ply has replaced balsa for fuselage sides and bulkheads. It's heavier, but less expensive—particularly in widths over 4 inches. Like all plywood, lite-ply is resistant to splitting, which makes it good for parts with sizable interior cutouts (like bulkheads).

Because it's not much tougher than hard balsa, however, lite-ply isn't the best choice for components that are subjected to a lot of stress, e.g. firewalls and landing-gear bulkheads. (Make these from birch plywood.) Lite-ply also varies considerably in quality. Less expensive grades can have "wild grain" and other surface flaws, which not only make finishing troublesome, but may also indicate a local reduction in strength.

Frank Tiano Enterprises just introduced a premium grade of lite-ply called "Mighty Lite"*. It's lovely-looking wood—flat and warp-free—with extremely uniform grain throughout and an impressively smooth

FASTENER FASCINATION

Clipping blind-nut prongs prevents distortion when they're installed in hardwood or birch ply.

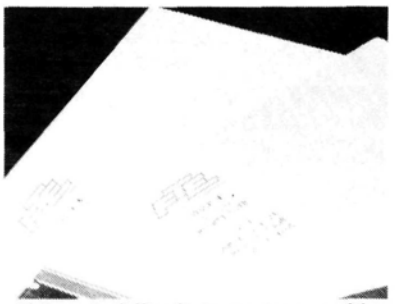
Fastening metal parts solidly to plywood requires a sewn (using thread) or a mechanical (using wood or machine screws and nuts) attachment. There are a few do's and don'ts to keep in mind with either method.

Don't sew landing-gear wire to a plywood bulkhead with ordinary polyester or cotton thread, because they can't take impact loads. Nylon is OK; Dacron (as used for 1/2A control lines) is better. *Do* drill plenty of holes, so you can sew the wire to the plywood all along the areas in contact. Glue the lacing with medium CA, and the wire and wood will be inseparable!

Wood screws work well in birch (aircraft-grade) ply, but they can't be trusted in poplar if major stress or vibration is expected. The wood is too soft, and the screws will work loose. Machine screws and nuts are better, but they require careful tightening (so as not to crush the wood) and some insurance against loosening, e.g., glue or a thread-locking compound like Loctite*.

Blind-nuts are also good for attachments in lite-ply and similar soft plywood. For best results in birch ply, however, they should be modified. Blind-nuts are made from soft brass or steel, and because their long prongs require so much pressure to be forced fully into a hard wood like birch or maple, they often deform badly. For use in hardwood, shorten the prongs by clipping them at an angle with sharp wire cutters. They only need to penetrate the wood deeply enough to prevent the nut from twisting when you tighten the screw. (CA applied all around the nut flange will hold it securely in place.)

You can also use machine screws in birch plywood as if they were wood screws! This requires accurate positioning of the holes; be as precise as



Although difficult to capture on film, Mighty Lite plywood's smooth, nearly flawless surface is proof of its impeccable quality.

surface. Mighty Lite costs about twice as much as commercial-grade lite-ply, but its consistency and exceptional quality make it worth the higher price.

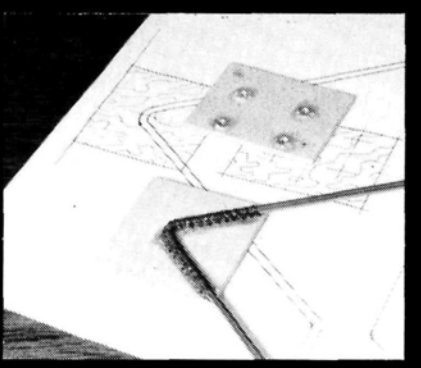
Less luan and mahogany plywood is used in modeling nowadays. The grain of this wood is much coarser and more fibrous than poplar or birch, and its edges tend to splinter. Mahogany's deep, reddish-brown color makes it attractive for parts such as "natural wood" instrument panels, but otherwise luan offers no special advantage for model planes.

Choose aircraft-grade ply for firewalls, landing-gear bulkheads, dihedral braces, servo-mounting platforms and similar stress-bearing parts. Birch is the hardest and strongest wood that's available in thin plywood. Because of its toughness, however, birch ply thicker than 1/16 inch is difficult to cut accurately with hand tools. I use a fine-tooth scroll-saw blade in an "economy model" Dremel jigsaw. (Coarse-tooth blades cause chipping and rough edges; fine-tooth ones cut more slowly, but they produce a much smoother job.)

Nearly all plywood is imported, and it's made mostly to metric

(Continued on page 128)

you would working with plastic or metal. The holes must be "tap size", i.e., the same size you'd drill in aluminum for cutting tapped threads. In birch ply (or a maple motor mount), you don't actually need to use a machinist's tap to form the threads, though.



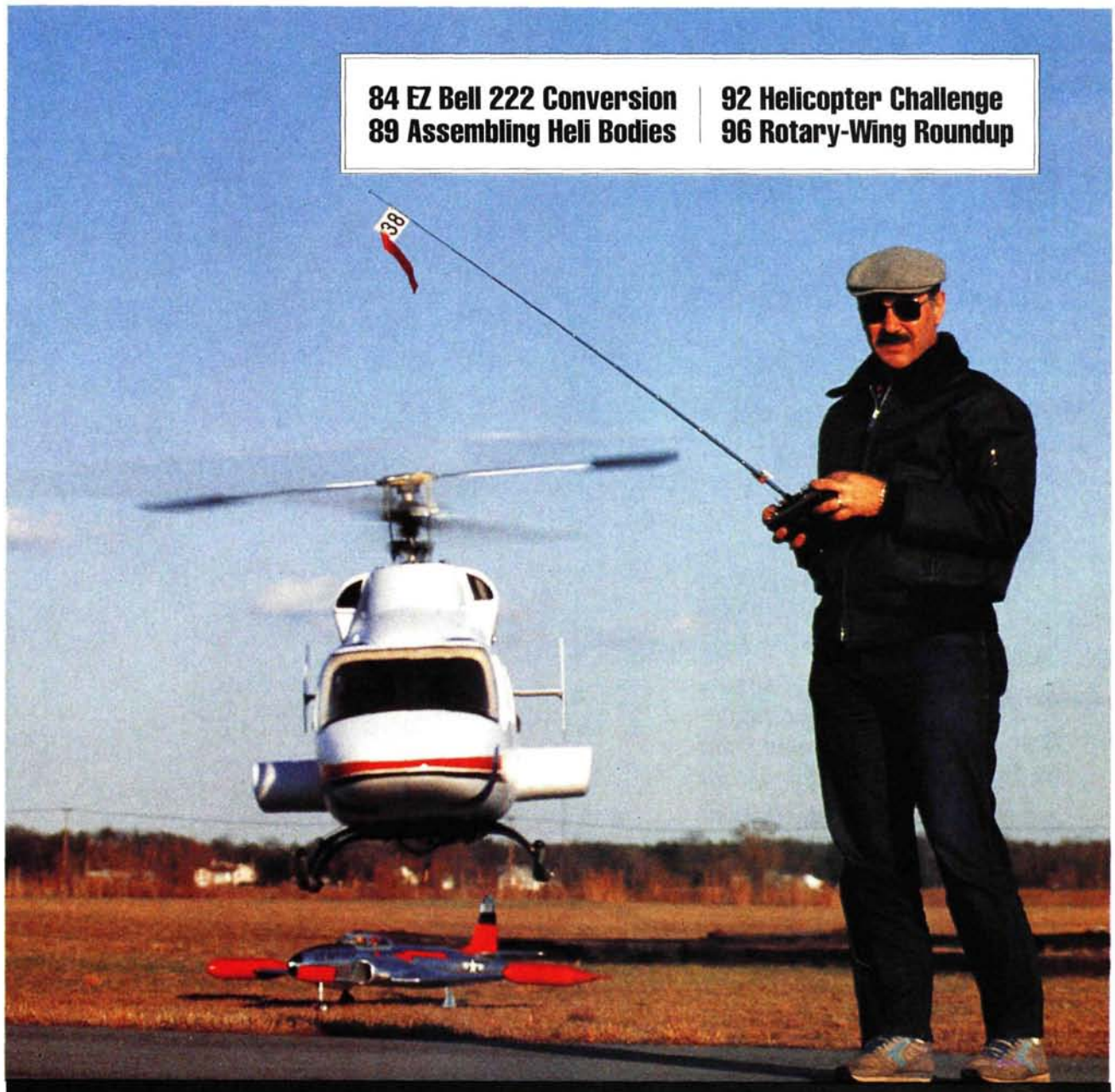
Typical metal-to-ply attachments. Note that the blind-nuts and the full-length lacing of the LG wire are firmly glued in place with CA.

For this size MACHINE SCREW, use this size DRILL:

2-56	#48
3-48	#44
4-40	#39
6-32	#33

Install the screws as if they were the self-tapping type. When installed this way in birch ply that's at least as thick as the screw diameter, a machine screw will hold as reliably as it does in a blind-nut. It's vibration-proof as well, even if the wood becomes oil-soaked.

HELICOPTER SECTION



This head-on view of a Bell 222, flown by Ron Farkas, is just one of the shots we took for his article in this month's Heli Section. Ron "denuded" his Hirobo Shuttle and installed a Sports Aviation EZ conversion body. He walks you through the process on the following pages.

In addition to his monthly "Heli Challenge," Craig Hath shows you the sometimes difficult process of assembling a heli body.

Coming next month: converting the Kyosho Concept to a Jet Ranger, painting heli canopies, selecting the correct tools for building and maintaining your machine, Dave Ramsey's helpful tips on caring for injection-molded parts...and more!

FIRST, LET'S HAVE a little history lesson to set the stage. Fifteen years ago, the few available R/C model helicopters were extremely crude, but their mechanics were generally built into a scale-like fiberglass body. Unfortunately, back then, very few people were able to fly successfully. As the mechanics evolved, designers favored aluminum pod-and-boom frames for their simplicity and reliability.

Then gyros and special radios came along, and these made helicopter flying possible (although still very expensive) for the average modeler, but only the most dedicated and proficient ones outfitted their machines with expensive, fiberglass, scale fuselages.

SPORT AVIATION

EZ BELL 222

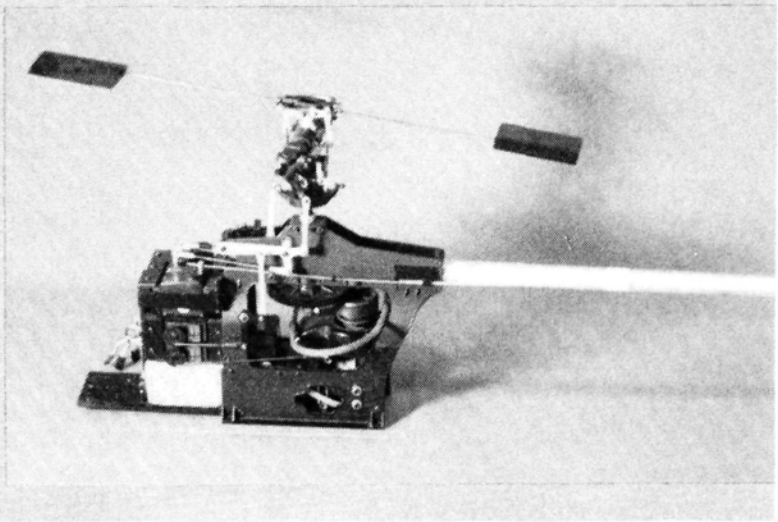
BODY CONVERSION

Go from sport to scale in just a few easy steps

by RON FARKAS

R&W BY RON FARKAS; Kodachromes by Rich Uravitch

Below: Before mounting the fuselage on this Hirobo Shuttle, the original body, fins and landing gear are removed.



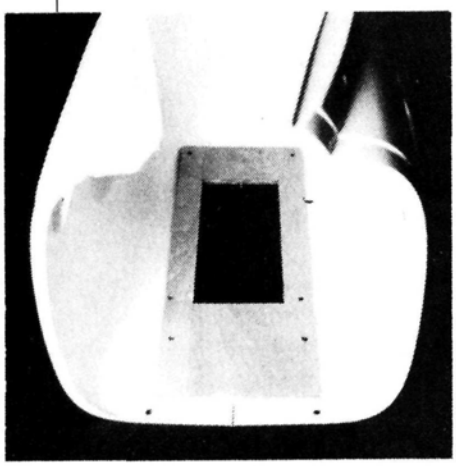
In the last few years, small, almost-ready-to-fly, inexpensive, composite-plastic machines have brought helicopter flying to the masses. Now, to complement these pod-and-boom kits, there's a new breed of economical, hang-on, plastic fuselages.

The Sports Aviation* EZ Bell 222 is a good example of this type of fuselage. Essentially, it's a light-gauge, vacu-formed shell that's placed over the entire frame of the R/C model. The visual transformation is dramatic. Although there are some compromises in scale accuracy, finish, strength and "maintainability," the idea is to have a lot more fun with only a little more effort and cost. The white, plastic fuselage doesn't even need to be painted; it comes with a large assortment of colorful stick-on trim patterns. The finished product looks great!

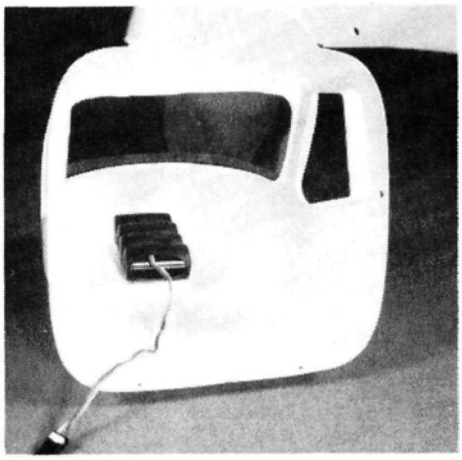
The EZ Bell 222 and its companion, the Jet Ranger, are designed to fit .30-size machines, and the instructions specifically discuss installation on the Hirobo* Shuttle, the Kalt* Baron and the Kyosho* Concept. The illustrations show a Shuttle, the helicopter on which I installed this fuselage. The instructions are brief but adequate, and it's wise to study them completely before starting because the best assembly sequence isn't always the order shown.

Everything you need (except glue) is supplied in the fuselage kit. The body shell consists of a nose section and a main section that extends back almost to the tail rotor. A pre-installed aluminum stabilizer spar loops under the helicopter's tail boom. Top and tail covers, side pods, fin shells, balsa fin cores and a windshield are also included. Depending on the helicopter you have, one to four plywood floor parts are used. Assorted hardware is also provided.

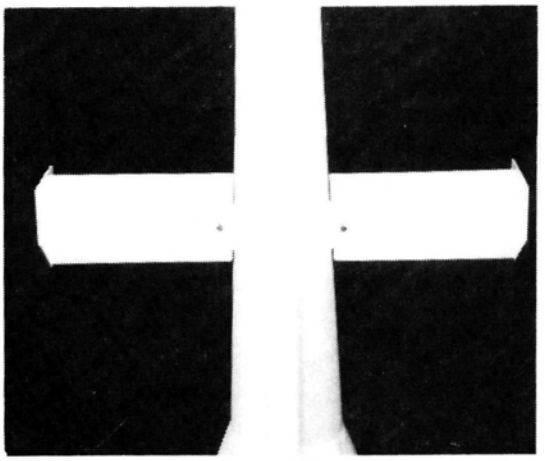
Begin by stripping your helicopter. Remove the canopy, landing gear, fins and tail rotor; all but the canopy will be re-installed. For Shuttles and Baron 30s, a replacement extended starting belt must be installed first. This is a good time to clean the machine



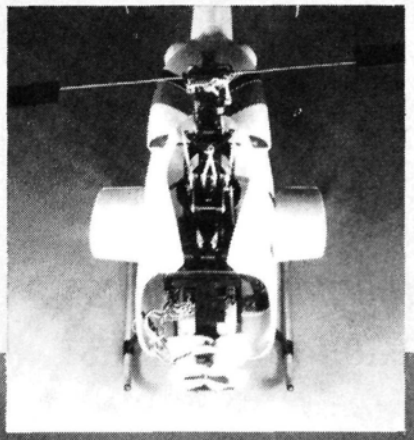
The main fuselage section is prepared by gluing in the floor and protective aluminum foil.



The small floor in forward section is the new battery location. Author used Velcro to hold battery in place.

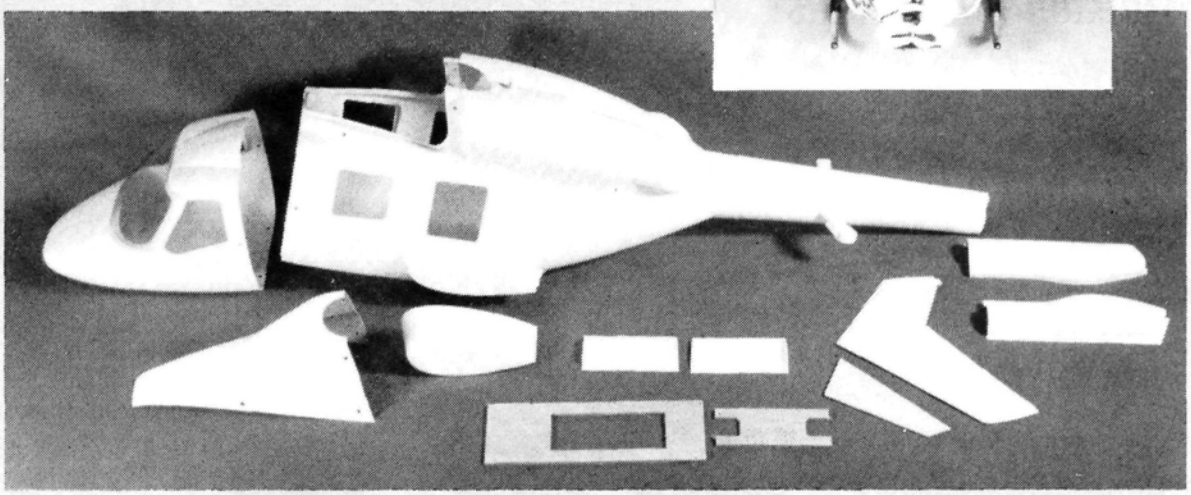


The author installed the stabilizers with screws (instead of glue) for improved "maintainability."



Below: The kit includes front and main vacu-formed-plastic fuselage shells, fin parts and decals.

Right: With the forward section removed, access to radio compartment is easy. Handy push-through fasteners are provided.

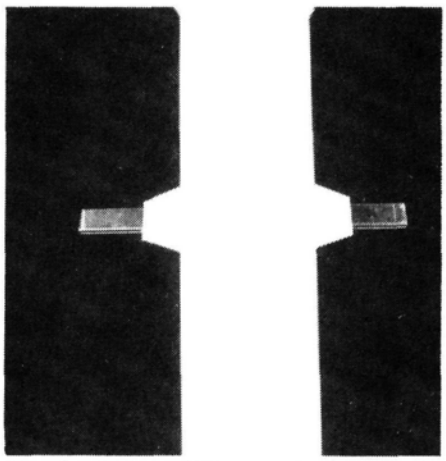


thoroughly, because grime can easily find its way onto the fuselage as you work.

Its soft, flexible plastic makes the unsupported fuselage difficult to handle, and extreme care is required in cutting and drilling. First, glue the plywood floor into the shell. To get a good bond, I placed the fuselage on a workbench and positioned the center seam between a couple of sheets of balsa so that I could press the floor down firmly.

The underside of the fuselage has several sets of dimples that correspond to the mounting-bolt locations for the various brands of helicopter frames. After drilling the holes, fuelproof the ply before continuing. Install the threaded-rod horizontal support through the helicopter side frames, and apply the aluminum-foil muffler heat shield to the fuselage interior.

Bolt the helicopter mechanics into the fuselage, and reinstall the landing gear. To make the fuselage seam line up, you might have to bend the threaded rod slightly. Cut access holes in the bottom for engine cooling, exhaust outlet and muffler-pressure line.



The aluminum stabilizer spar is shaped to fit around the tail boom and installed in the fuselage shell.

Next, install the aft top cover with double-sided tape. I couldn't get my hand inside, so it was really difficult to make the tape stick. I resorted to pushing a stick through the fuselage and up against the inside, while pressing my hand down on the outside. The top tail-boom cover is also attached with double-sided tape, but it's easier to apply because the plastic is more rigid there.

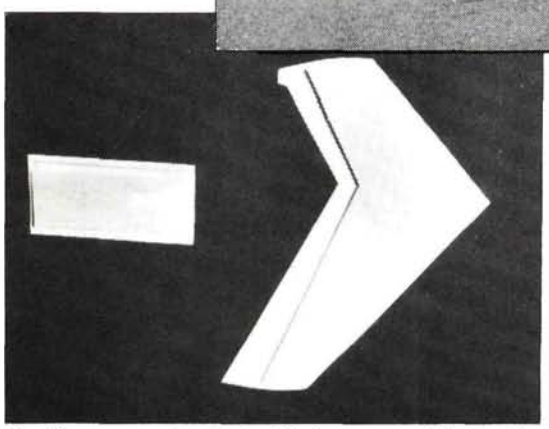
Glue the forward top cover onto the front of the body; this assembly is then attached to the main fuselage with special push-through cowl fasteners. This is the only section that's removable for routine maintenance, and it provides good access to the entire radio installation.

The tail gearbox side covers are then installed with self-tapping screws. The material was so thin and flexible that I couldn't even drill it using a pin vise without tearing through the edge. I glued scrap-plastic reinforcing strips around the perimeter of the shells, and I felt reasonably confident that the screws would at least hold in normal use.

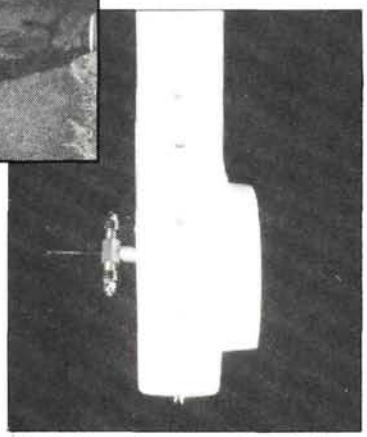
The horizontal stabilizers and vertical fin are made by gluing plastic skins over a sheet-balsa core. The fin is glued to the tail cover, and the stabs are supposed to be slipped over the aluminum spar and glued permanently to the boom cover. If you do this, there's no way to remove the fuselage without serious damage; instead, I attached the stabilizers with machine screws and nuts through the aluminum spar. I didn't use all the double-sided tape on the top covers, just in case I have to pull them off later. Considering all the service a helicopter requires, the fuselage should have been designed to be removeable.

That's it for construction. It's difficult to describe in just a few words, and that's why the illustrated instructions with assembly notes are so appropriate for

Weight certainly isn't a problem; because the fuselage is more streamlined and has a greater fin area, fast forward flight even seems to be improved.



The fins are made of sheet-balsa cores with plastic skins.



The tail gearbox cover is made from shells that are screwed together at the center seam, which the author reinforced with scrap plastic strip.

this kit.

Applying the decals is the final task. Sketches indicate where each piece is found on its sheet and where it belongs on the fuselage. My kit had a complete set of extras. They're a bit tricky to apply, but they stretch around curves fairly well, and very light heat from a hair dryer also helps to make them conform to the compound curves. Fuel residue doesn't accumulate on the exterior of helicopter fuselages, so the decals should hold up pretty well.

To maintain the original center of gravity, move the battery to the floor of the front section. The machine should hover the same as before. Weight certainly isn't a problem; because the fuselage is more streamlined and has a greater fin area, fast forward flight even seems to be improved.

For those who take their scale helicopters very seriously, a larger model with a fiberglass fuselage is still the way to go. On the other hand, the vacuformed, hang-on fuselage provides a lot of satisfaction and enjoyment for a much smaller investment, as long as you can accept the compromises in scale fidelity and quality. The bottom line? It's a blast to fly a .30-size helicopter with the EZ Bell 222 fuselage.

**Here are the addresses of the companies mentioned in this article:*
Sports Aviation; *distributed by Global Hobbies, 10725 Ellis Ave., Fountain Valley, CA 92728.*
Hirobo; *distributed by Altech Marketing, P.O. Box 391, Edison, NJ 08818-0391.*
Kalt; *distributed by Hobby Dynamics, 4105 Fieldstone, Champaign, IL 61821.*
Kyosho/Great Planes, *P.O. Box 4021, Champaign, IL 61820.* ■

ASSEMBLING HELI BODIES

NEATNESS COUNTS AS MUCH AS TECHNIQUE; HERE'S HOW!

by CRAIG HATH

DO YOU WANT to know how to put together a helicopter body so it's ready for a great finish? Here are some tips:

WHAT'S YOUR BODY TYPE?

The bodies included with most popular helicopter kits are made of clear or tinted molded Lexan (or polycarbonate), white or colored thin polystyrene, or a heavier ABS material that can be molded in any color. Each type requires a slightly different assembly technique. The body shown being assembled in the photographs is that of a Miniature Aircraft* USA X-Cell 60, and it's made of molded Lexan—the material most often used for kit bodies.

NO MORE FAT LIP

Lexan bodies are usually shipped from the factory in halves. Each has a considerable "lip"—or molding flash—along its gluing surface, and you'll have to trim it down to approximately 1/4 to 3/16 inch. (We'll trim it even more after gluing.)

Using a single-edge razor blade or an X-Acto knife, score a line along the straight and slightly curved parts of the lip. As you reach sharp curves and corners, either continue the scoring straight off the lip, or curve it away from the body until it runs off the edge. *Don't* attempt to score the lip around these sharp curves, because snapping it off in these areas can crack the body.

Bend the lip back and forth along the score lines, and it should break away from the body cleanly. With a pair of scissors, trim the lip that remains around the sharp curves. Once again, use caution when working around curves; they may crack if you try to remove too much material at once. Be careful not to allow your scissors to work in toward the body as you trim; this will leave a gluing surface that's too narrow.

Using 150- to 220-grit sandpaper on a small sanding block, roughen the entire sealing-lip area on both body halves. (This is important for achieving a good glue joint.) Polystyrene and ABS bodies are usually trimmed at the factory, and they come either pre-assembled (most ABS bodies come this way), or ready to glue together.

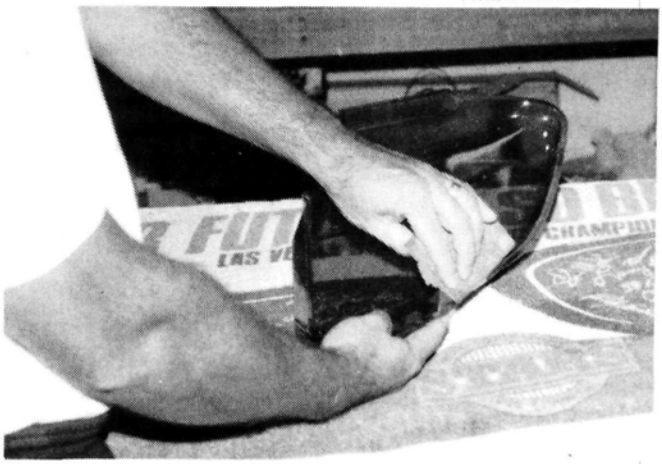
GET IT TOGETHER

For all bodies, align the halves as closely as possible, and hold them in place using small strips of cellophane tape along the outside of the glue joint. You can also use small C-clamps or large paper clips, as shown in the photos. Adjust the alignment until you're satisfied, and then apply glue to the joints, according to the manufacturer's recommendation. Lexan bodies can be glued with CAs, but it's best to use a grade intended for use on plastic, as this glue is slightly flexible when cured.

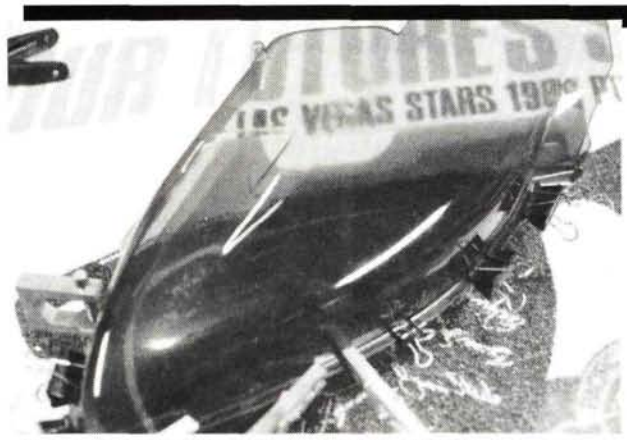
Hold the body with the joint pointing downwards, apply CA to the inside of the glue joint, and let it flow along the joint all the way to the nose. Let the glue set, then turn the body over and repeat on the other side. Remember, you're working from the *inside* of the glue joint.

PHOTOS BY CRAIG HATH

Begin by scoring and trimming molding flash to approximately 1/4 inch. Use a single-edge razor blade, and be careful around sharp corners.



Roughen gluing surfaces with 150- to 220-grit sandpaper.



Align the halves, clamp them together and glue.

When the glue has cured, sand the remaining lip down to approximately 1/8 inch.

ASSEMBLING HELI BODIES

Polystyrene and ABS bodies require solvent-based adhesives, which are usually included in the helicopter kit or are available separately from the kit manufacturer. To apply these glues, dip a "Q-Tip" in the solvent, then wipe it gently along the glue joint on the inside of the body. The solvent will wick into the joint, and if used sparingly, it will set in a few minutes. Once the main body joint has been completely glued, add any reinforcing strips or mounting stooges. Then, go back over all the joints and check for strength.

HEADING FOR THE FINISH

If you have a bench-mounted disc sander, you can quickly sand the lip all around a Lexan body (now two plies thick) down to approximately 1/8 inch. Be sure not to let the sander touch any other part, as it will leave a permanent scratch. A flat file can also be used to file the lip down to the proper size. Your heli body is now ready for finishing, so stay tuned—finishing techniques will appear in the next issue!

Here's the address of the company mentioned in this article:* ***Miniature Aircraft USA,* *2324 N Orange Blossom Trail, Orlando, FL 32804.* ■

Helicopter Challenge

by CRAIG HATH

MORE SET-UP HELP AND GYRO FACTS

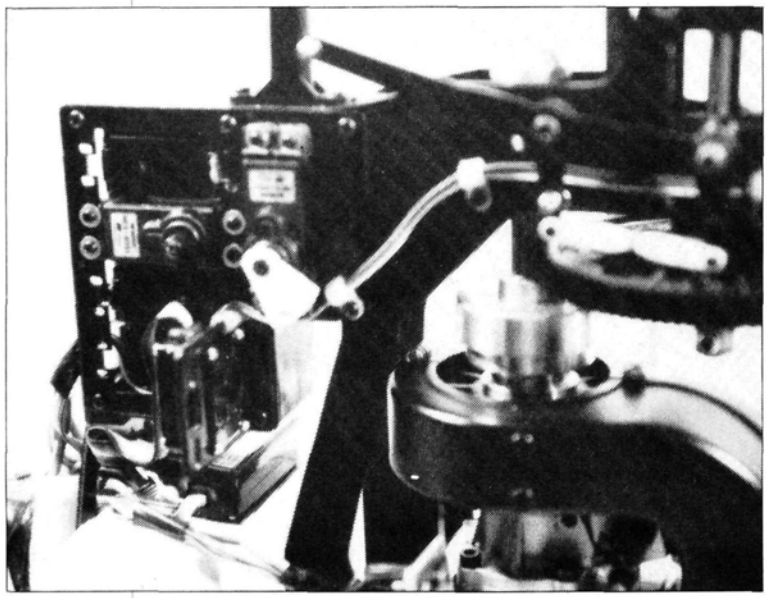
FINAL ASSEMBLY

Now that the major pieces of your new helicopter are assembled and all the R/C systems are working, it's time to prepare the machine for the final buttoning-up!

First, give the radio-component installation a good once-over. Take a look at the receiver and battery packs; how do you have these installed? Make sure that all free-floating parts (i.e., those not directly attached to the helicopter) are wrapped in vibration- and shock-resistant foam and tied down so that they can't flop around inside the model.

If space is available in the front bed area, this is the place for the battery pack and receiver. Cover the component *loosely* with foam, and wrap it with duct tape. If you wrap the foam too tightly, it will be compressed, and this will reduce its ability to dampen shock and vibration.

Next, attach the part to the front bed with cable ties. (If the bed is wooden, drill holes large enough for the cable ties to pass through.) Once again, the cable ties should be tight enough to prevent the part from falling out of place, but not so tight that the cushioning effect of the foam is diminished.

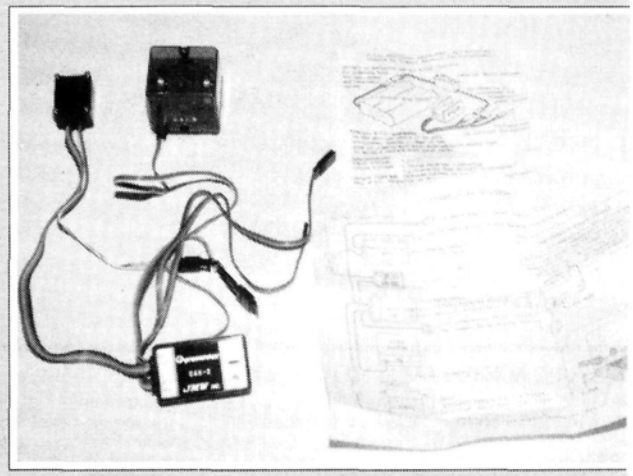


Neat routing of servo leads, cushion-mounted receiver and battery pack and switch-mounting brackets are visible in this shot.

I sometimes use Velcro to attach radio components to the helicopter. A strip of each of the two parts of the Velcro (hook-and-eye) material is attached to the heli. These strips are positioned on each side of the component to be retained. Joining the two Velcro strips with the component in place will ensure that it remains in position; it also allows you to remove the part easily.

Gyro installation requires special attention (see

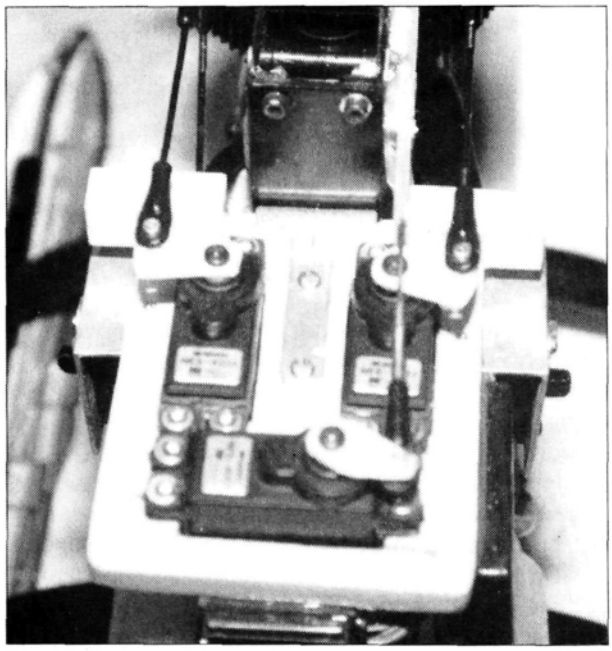
PHOTOS BY CRAIG HATH



Read the instructions that come with your gyro! This is the JMW gyro, and is typical of the many available.

GYRO INSTALLATION

A properly installed gyrosensor will enable you to get the full potential from your model. My first encounter with a gyro wasn't very successful: after making several attempts to get it to operate to my satisfaction, I finally gave up and removed it from the helicopter. A few years later, I took it out again and installed it in a different helicopter, and it worked fine. I probably installed it backwards in the first helicopter! If I'd had better information at the time, I could have been spared a lot of frustration. By following a few of the simple tips outlined here, I hope that you'll have instant success with this useful flight aid.



Servo arms are trimmed to avoid snagging other controls, and linkages. Hand-made switch-mounting brackets are also visible.

sidebar). Mount all switches to some part of the helicopter where they can be easily reached. I don't like to mount switches to the helicopter body, because it makes it difficult to remove the body. On the other hand, attaching the switches to the helicopter frame makes them susceptible to vibration damage.

I lost one of my machines because of a switch-harness failure; since then, I've been experimenting with shock-mounting the switches. One method is

BASIC INSTALLATION

Before you install the gyro, read the instruction manual *completely.* Choose a good, flat location to mount the main gyro; the closer to the CG, the more effective it will be. Mount the gyro with a good grade of double-faced foam tape, and wrap a rubber band or cable tie around it and its mount to keep it from shaking loose from its mounting location. Don't have too much pressure holding it down; it should be slightly shock-mounted.

Mount the switch harness and control box (or boxes, depending on your gyro) in a convenient place. Wrap the box in foam to protect it from vibration damage (just as you would the receiver and battery pack). If the control box on your gyro has provisions for sensitivity or neutral adjustments, be sure that they'll be easily accessible when you're at the flying field.

The faster the transit time of the servo that you use for tail rotor-pitch control, the faster and more responsive your gyro will be. For this reason, use a good-quality, high-speed servo.

CHECKING FOR PROPER OPERATION

When the gyro is installed, turn the power on, and check it for proper operation. To detect operation more easily, turn the sensitivity adjustment to the maximum position. Next, turn the transmitter on and move the tail rotor-pitch control stick to the left, while observing the movement of the tail rotor-pitch servo. After you determine the direction of travel that gives left tail rotor-pitch control, move the nose of the helicopter to the *right,* and watch the tail rotor-pitch control servo: it should move in the direction that gives *left* tail rotor. Repeat this exercise until you're sure about the direction of the tail rotor-pitch servo.

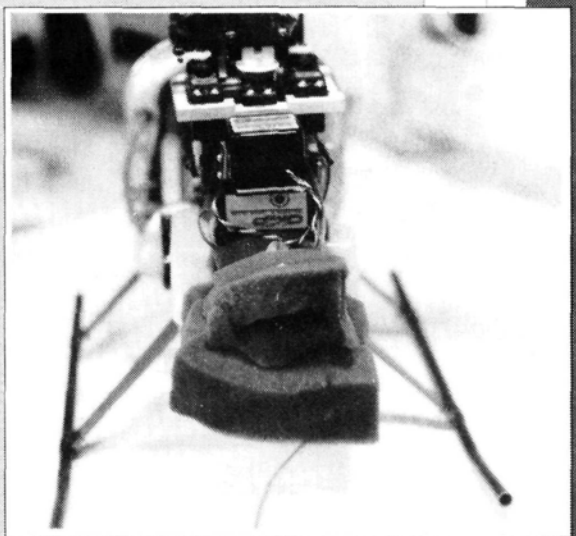
If your servo moves in the direction of right tail rotor pitch, the gyro is operating backwards. In this case, you have to do one of three things:

- If you're lucky enough to have a gyro with a reversing switch, simply locate the switch, reverse the gyro direction, and re-check the operation of the gyro.
- Install a reverse-direction servo (consult the radio system's manufacturer for information on these), and re-check the gyro operation. (If linkage arrangement allows, you can connect to the other side of the servo output arm.)
- Turn the gyrosensor unit upside down, and re-check for proper operation. This is a last resort, because some units wear quickly when installed in this configuration.

SETTING SENSITIVITY

Depending on the gyro/servo combination, start with the gyro sensitivity set to approximately 50 to 70 percent. At the flying field, adjust the sensitivity as high as possible. To do this, turn the sensitivity up until the tail rotor starts to "swim" in the hover; then back it down to just below this point, and you'll have it. Some gyros tend to override or diminish tail-rotor authority. To regain normal tail-rotor control, you might have to increase the mechanical pitch travel of the tail rotor-pitch control linkage, or decrease gyro sensitivity.

If you have any problems getting the gyro to work properly, go back over these steps, and pay special attention to the proper direction of operation. With a little effort, you'll have a great tool that will help you learn and add finesse to your flying.



The gyrosensor is attached to the gyro mount with double-sided tape, and the control unit is mounted underneath this mount. To help hold it in place, rubber bands were later wrapped around the gyro.

to mount the switch to the servo tray or bed (where you can still reach it without removing the body) with double-sided tape; then secure the switch with a small cable tie (just in case the tape lets go).

Another idea is to make an aluminum mounting bracket for the switches. Attach this to the frame of the helicopter, and sandwich a few pieces of bicycle inner-tube rubber between the bracket and frame. Whatever method you choose, smart shock-mounting could save your machine.

ANTENNA ADVICE

Route the receiver antenna away from all servos; don't let it touch metal parts *anywhere!* I usually use a whip antenna (the internal type, taped to the inside of the canopy). For best results, have an authorized service center install your whip antenna and re-tune your receiver. Whip antennas are probably the most reliable system for eliminating radio interference caused by metal noise, which occurs when metal parts grind against each other (usually because of a lack of lubrication). This noise is often very similar to the radio frequency on which our planes operate, and this can cause interference.

One of my helicopters that didn't have a whip antenna would "lock out" whenever it made left-hand, level turns at speed, and it nearly caused the machine to crash. I couldn't figure out what was happening until I thought about the effect of wind on the receiver antenna in this type of turn. Sure enough, the antenna could blow right up and touch the metal tail boom—instant interference! Re-routing the antenna cured the problem.

CHECKING THE CG

To check the center of gravity (CG), lift the helicopter by its flybar off the workbench, while you watch which part of the skids comes off of the bench first. Ideally, the rear of the skids should lift off the bench first; this indicates that the CG is slightly forward. Most helicopters need some weight added to the nose. If you have a secure place to attach it, stick-on tape-weight works well. The farther forward you can put the weight, the less you'll need to correct the CG.

Finally, be sure that no servo wires are hanging where they will rub on any moving part, or come in contact with any part of the exhaust system. To make a neat wire harness, I route servo leads and tie them together with cable ties. This is simply a matter of preference, but it makes the installation look that much cleaner.

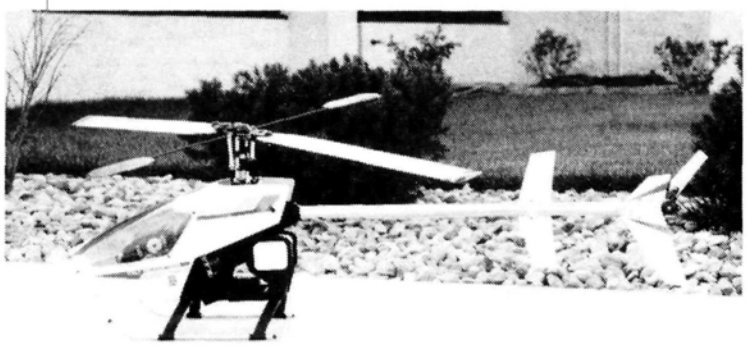
Go over the entire machine one last time, and check that all nuts and bolts have been tightened. Double-check that the movement of mechanical parts and control systems are bind- and slop-free and are working in the proper directions. Next month, we'll take a look at pre-flight checklists and what to take to the flying field. See you then! ■

ROTARY-WING ROUNDUP

GORHAM MODEL PRODUCTS Legend FTB

The Legend has been designed and manufactured with many advanced features new to R/C helicopters, and this gives it a wide range of applications. The standard 900FTB has a flybarless rotor head; a space-age, toothed-belt, tail-drive system; and autorotation. Legend upgrade kits for the Cobra and the Competitor are also available.

Price: $655
For more information, contact Gorham Model Products, 23961 Craftsman Rd., Calabasas, CA 91302.



KALT ENFORCER

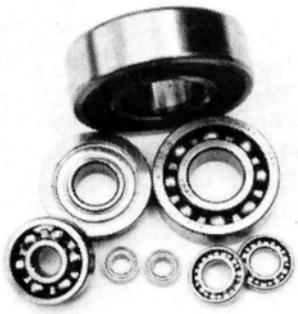
This .30-size RTF features a fully aerobatic rotor head; patented mixing system; top cone starter; forward-canted engine; highly efficient, sealed transmission with a planetary drive-gear assembly; high-quality balanced rotor blades; modular design for easy maintenance; and readily available parts.

For more information, contact Hobby Dynamics, 4105 Fieldstone, Champaign, IL 61821.

LENCO HOBBIES Proformer .60-Size Fuselage Kit

The Proformer is an easy-to-assemble, durable, two-piece, slip-on fuselage kit. Its removeable front section allows complete access to all mechanics while retaining the stock aluminum tail boom for easy alignment. Proformer's design requires no additional formers for mounting, and it's molded with an ultra-smooth, white, gel-coat finish that's completely fuelproof and requires no painting. Proformer adds less than 1/2 pound to the total flying weight of the helicopter. The kit comes complete with all hardware and complete instructions for mounting on Scout .60 or Champion mechanics; it will fit other .60-size mechanics with slight modification to the mounting brackets.

Price: $279.95
For more information, contact Lenco Hobbies, Beach Shopping Center, Route 6, Peekskill, NY 10566.



BOCA BEARINGS
Helicopter Bearing Guide

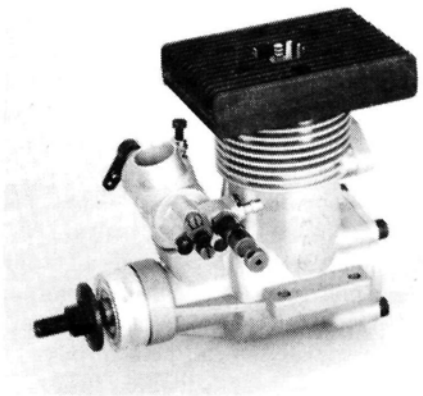
Boca Bearings offers an updated version of its original helicopter bearing guide. New helicopter models now include GMP Rebel, Kalt Cyclone II, Kyosho Concept 30 and Miniature Aircraft 30 and 40.

Price: $3
For more information, contact Boca Bearing Co., 7040 W. Palmetto Park Rd., Suite 2304A, Boca Raton, FL 33433.

O.S. .61 RFN-H & .61 RFN-H ABC

Ideal for American-style flying, the O.S. .61 RFN-H weighs 20.5 ounces and has an rpm range of 2,000 to 16,000, and 1.7bhp at 16,000rpm. This allows tight loops and rolls without hesitation. The .61 RFN-H is available in ringed or ABC versions.

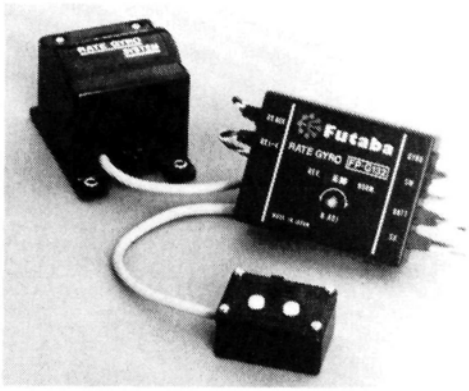
Part no. OSMG1988; OSMG1989. Price: $289.95; $299.95
For more information, contact Great Planes, P.O. Box 4021, Champaign, IL 61820.



AEROTREND SKID STOPS

Skid Stops are 3/4-inch-long pieces of specially formulated silicone that protect helicopter skids from excessive wear, damage and vibration and help steady it for takeoff and landing. Available in small and large sizes, they come in black/white, all black, or all white.

Part no. 1270 to 1275. Price: $4.99/package of 8
For more information, contact Aerotrend Products, 31 Nichols St., Ansonia, CA 06401.



FUTABA
Voltage-Regulated Rate Gyro

Futaba's new single-axis gyro systems now offer voltage regulation, which will precisely stabilize R/C model aircraft. The systems detect and automatically correct motion on a predetermined axis. Both the G132 (standard) and the G152 (J-series) gyros can be positioned for yaw, roll, or pitch correction in helicopters and airplanes.

For more information, contact Futaba Corp., 4 Studebaker, Irvine, CA 92718.

JAVELIN

(Continued from page 72)

be great, but use medium balsa everywhere else. The stabilizer uses capstrip ribs. Soak the upper caps in ammonia water and shape them with your fingers before you install them. Note that the hinges are the polypropylene-strip type that suits the thin structure.

THE FUSELAGE

This is a simple box structure to which some fairing has been added. Assemble on a center line with the lower side edge down. With the sides and bulkheads joined, add all the top structures *before* removing everything from the board, to ensure that the alignment will be maintained. When everything is off the board, add the floor to the equipment compartment. Use firm balsa in the battery section because heavy batteries display a lot of inertia on a hard landing! Now the full-length bottom stringer and associated sheeting can be added.

When you've completed the balsa structure, attach the motor. Note the simple mounting plate that fits between the gearbox and the motor. With the motor in place, add large blocks of Styrofoam to the nose section as indicated. The cowling needs a 1/8-inch square backplate keyed around the gearbox and a 1/16-inch ply spinner ring press-fit onto the propeller drive washer. Fill the areas around the gearbox and between the spinner ring and backplate with chunks of foam.

With the foam in place, carve and sand the whole part to fair the spinner into the fuselage. When you've done this, add the 1/8-inch-square spruce landing skid.

The sub-fin is simple enough, but do ensure vertical alignment, as this controls the rudder alignment also. Note that the rudder hinge is a 2-inch length of polypropylene. If you only have shorter strips, just fill the 2-inch space with them.

RADIO INSTALLATION

There isn't much to this. Note how the servo rails are installed; this method saves adding extra reinforcements, and it works well. The receiver and both batteries are all held in place with rubber bands and suitable hooks. I use the simple, dependable 1/16-inch wire pushrods that run through fairleads, but any other type will work, so it's your choice.

ALIGNMENT

Alignment is perhaps the most important step in the construction of any model, and care taken here pays big dividends! With the wing "doweled" into place, measure from each polyhedral TE joint to the tail post and make sure all these measurements are equal. Drill and tap for the mounting screw, then, on the center line of the wing's LE bulkhead, install a straight pin.

On the stab bottom, draw a precise center line, on which you mark and drill the required mounting holes. Put the stab onto its mount, then drill and tap the mount for the *aft screw only*. Attach the stab with this screw.

Now, measuring from the "pin" to the stab tip trailing edges, equalize the distances, then drill and tap the mount for the forward screw. With the wing in place, check the stab's horizontal alignment to it, and shim the stab mount to make any necessary corrections. With the airframe completed, you're ready to sand the entire structure well with no. 320-grit paper to prepare for covering.

GLASSING THE NOSE

Cover the fuselage with 1 1/2-ounce fiber-

glass cloth and resin back as far as the wing LE. Apply a layer to the *cowl only* at first, then apply a layer back to the wing. The cowl needs two layers. When the covering has dried, sand it and apply another coat of resin. When that's dry, sand the glassed area until it's smooth. Remove the cowl from the fuselage and finish it with a coat of paint.

COVERING

I covered the entire model with Coverite's* Black Baron film, which goes on easily and is durable. It comes with excellent instructions, but I have a few suggestions. When covering the wing and stab, orient the span with the length of the roll so that there will be less sagging between the ribs.

Initially, shrink the covering with the same low heat you used to attach it. After that, you can remove wrinkles with a slightly higher heat setting. For trim, simply iron a contrasting color scheme over the base covering. Since this is a "no-fuel" model, it will stay put.

PERFORMANCE

The balance point shown is about optimum, and with fixed EP components, it should be there almost automatically. Actually, there *is* some range; I've flown further aft with just a minor increase in stab incidence to compensate. Within reasonable limits, you shouldn't have a problem with stability—just don't go to an extreme aft position!

For a test flight with a high-performance EP you're in the same position as with free flight. Before using full power, it would be comforting to know how a plane will react. If you have spare batteries, using 800mAh SC cells will reduce power a little, and a 6-cell pack will reduce it even further. Do be sure to do any low-speed testing on a *calm* day!

Assuming that the test flights are at low speeds, watch the flight attitude carefully and use transmitter trims to obtain straight flight with a shallow climb angle. After landing, adjust the pushrods to give the same settings with the trim levers in neutral. (The prototype flew with all controls in neutral.)

When you're satisfied with the low-speed tests, you can confidently use full power. With the common 800 or 1.2 SC cells, the best climb angle seems to be between 30 and 45 degrees. Even though we have R/C, it seems logical to adjust power on flight with surface settings à la FF. Then fly the glide portion with trim, *if necessary*. With FF power adjustments we still have R/C for any needed corrections. The power climb will be smoother and less demanding if we let the *plane* do it!

To obtain optimum climb angle and speed, use elevator trim for your evaluation, and when you're satisfied, note the required trim and replace it with a stab-incidence change to suit you. This careful "tweaking" should produce a hands-off powered flight.

When the powered flight has been "tweaked out," you should find that the glide phase is also satisfactory. Hands-off glide should be relatively straight and have a flat attitude. The fuselage should be parallel to the horizon, not nose-up or nose-down. In calm air, the sink rate can be reduced by raising the nose slightly with up-trim. In "active" air, however, such a setting will reduce penetration. With lift, you'll probably want to circle, and this can be tight using rudder and up-elevator together. In this mode, the Javelin will almost chase its tail!

If you use more power, as I described, little will change except the angle and

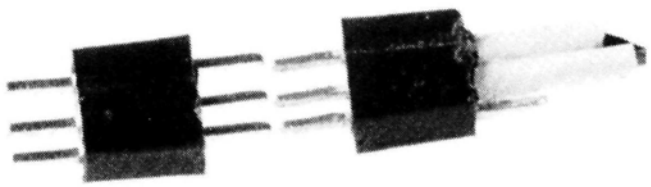
(Continued on page 103)

BASICS OF

OF RADIO CONTROL

by RANDY RANDOLPH

Incompatible connections, prop balancing and cardboard parts holders



The ubiquitous Deans connector isn't the same as it used to be. Old one on the right; new on the left.

IT'S A SAD FACT that Deans connectors made a few years ago don't mate properly with those produced recently. Since Deans connectors are among the most reliable in the industry, it was almost standard procedure to replace the connectors in some radio systems with Deans gold-plated beauties before ever using it! It's anyone's guess why the spacing and pin size on the newer connectors were changed, because literally hundreds of thousands of the older ones are in service all over the world.

If you have a misfit, don't force a connection or file the offending plug to make it fit. It's much smarter to change one of the plugs rather than to damage both. If you're unfamiliar with these connectors, our "How To" in this issue tells you how to assemble them.

PROP(ER) BALANCING

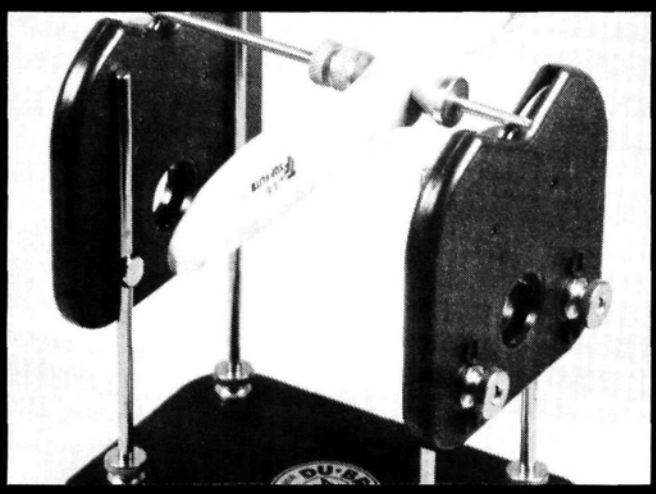
Vibration has always been a problem for aircraft structures and the electronics they carry. Now, vibration-reducing engine mounts are available for smaller engines (e.g., those by J'Tec*), as well as the larger (even 1/4-scale) sizes. This improvement in mounting mustn't be considered an excuse to allow prop vibration to continue. Vibration caused by an out-of-balance propeller can and should be eliminated.

A slight difference in the pitch of the blades transmits more vibration to the engine than an imbalance caused by uneven weight distribution; however, it's difficult to correct a pitch difference, but it's fairly easy to find and correct a weight problem. Before they're used, props should be checked for balance; if you detect vibration, replace the prop.

When balancing a prop, first ensure that the mounting hole is centered. To do this, put the prop in the balancing device and rotate the tips past a fixed point. At the same time, check the track of both tips. After these tests have been made, the heavier blade can be sanded until the prop is balanced.

Propellers aren't expensive; radios and engines are! It's foolish—and dangerous—to use nicked or otherwise damaged props that could destroy several hundred dollars' worth of airplane and radio equipment.

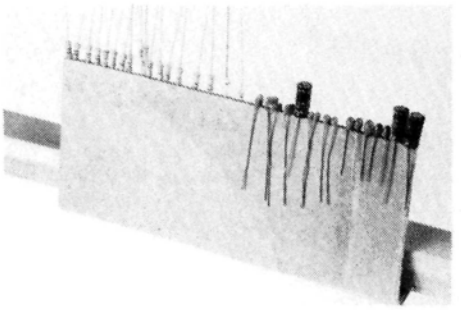
One more thing: vibration seems to affect the operation of Nyrod-type



PROP BALANCING

Each side of the Du-Bro* prop-balancing device houses two, precision, metal wheels that are mounted on brass bearings. Between these wheels rests the spindle that carries the prop. This system is very similar to one that's used to balance full-scale propellers, and it's about the most sensitive available for model use.

When balancing a propeller, remove material from the front (or "airfoiled") side of the blade rather than from the back (pitch-determining) side.



ELECTRONIC PARTS HOLDER

Most of us build our airplanes from kits, so it goes without saying that other items in kit form appeal to us. Many electronic accessories are available in kits, including everything from battery chargers and tachometers to complete radio systems. All have something in common: small electronic parts.

Here's a way to keep track of these small parts. Bend a piece of corrugated cardboard so that it can be held upright by a weight of some sort. The condensers, resistors and solid-state devices are slipped into the pockets formed by the corrugations. The value of each component can be written below it on the cardboard. It's always a good idea to recheck each part for its value before you install it.

pushrods. A new system, which has grooves in the outer sheath rather than the sliding inner rod, appears to be less affected by vibration. Any difference would be more noticeable in sharp bends than in straight runs.

NARROW-BAND BLUES

There still seems to be some confusion about the term "narrow-band frequency modulation" (NBFM). It simply means that the emissions from an FM transmitter are reduced to the same bandwidth as those from an amplitude-modulated (AM) transmitter. The radiated signal from these NBFM systems takes up no more space in the frequency spectrum than a properly modulated AM system. There's only one drawback: when FM signals are reduced in bandwidth to the same width as AM signals, they're only about 70 percent as efficient, at best. Don't believe anyone who tells you something different. That's basic!

**Here are the addresses of the companies mentioned in this article:*
J'Tec, *164 School St., Daly City, CA 94014.*
Du-Bro Products, *480 Bonner Rd., Wauconda, IL 60084.* ■

JAVELIN

(Continued from page 99)

speed of climb. With maximum power, the angle can be from 60 to 80 degrees at an even faster speed. Adjust for this in the same way. About the only difference between normal and high power is that you'll get to altitude about one-third faster with the high power, but, of course, motor run time will be shorter.

One final thought: the Javelin has good penetration and will fly in any reasonable wind. Much of my flying has been done in winds of 10 to 20mph, and the only difference is that, in light wind, you have to concentrate more, just to be safe.

I hope you find the Javelin attractive and can see how the subtle design refinements have produced improvements. It's a simple, easy-to-fly, high-performance electric-powered plane that I hope you'll consider when you're thinking of competing, or you just want to enjoy some eye-opening sport flying. If you do, you won't be sorry!

**Here are the addresses of the companies mentioned in this article:*
Astro Flight, *13311 Beach Ave., Marina Del Rey, CA 90292.*
Bolly props; *imported by Tom Dixon Ste. #401, 1938 Peachtree Rd., Atlanta, GA. 30309.*
Airtronics Inc., *11 Autry, Irvine, CA 92718.*
Hot Stuff, *Satellite City, P.O. Box 836, Simi, CA 93062.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.* ■

FUN-FLY SHOOTOUT

(Continued from page 30)

ROOP DA ROOP

Even though there was a great banquet and much revelry on Saturday night, we were all ready for Sunday morning. Out at the field, a blustery wind blew directly into the pilots' faces as they faced the next contest, in which, to quicken the pace, two events were combined.

The wind was a big factor. The two events started as "Roops"—a takeoff followed by a roll, a loop, a roll, a loop, and so on for four cycles. The second event required precision touch-and-go's into "the spot"—a 10-foot circle. Unfortunately, the wind prevented pilots from hitting the spot with any regularity, so the target area was enlarged to 20 feet to increase the pilots' chances of success.

Again, the specialized birds performed the combination "roops" with the touch-and-go spots within the high 20s. Florio Flyer Kevin Siemonsen gave a shining performance with his conventional, piped, Rossi 60-powered Florio bird: it punched quickly through the "roops" and then hit the spot twice, pirouetting on its wing tip within inches of the deck. Kevin then slammed it to a landing that damaged nothing but a blade of grass. The crowd went wild, and Kevin scored his flight in only 28 seconds.

Jerry Smith won this event, and only

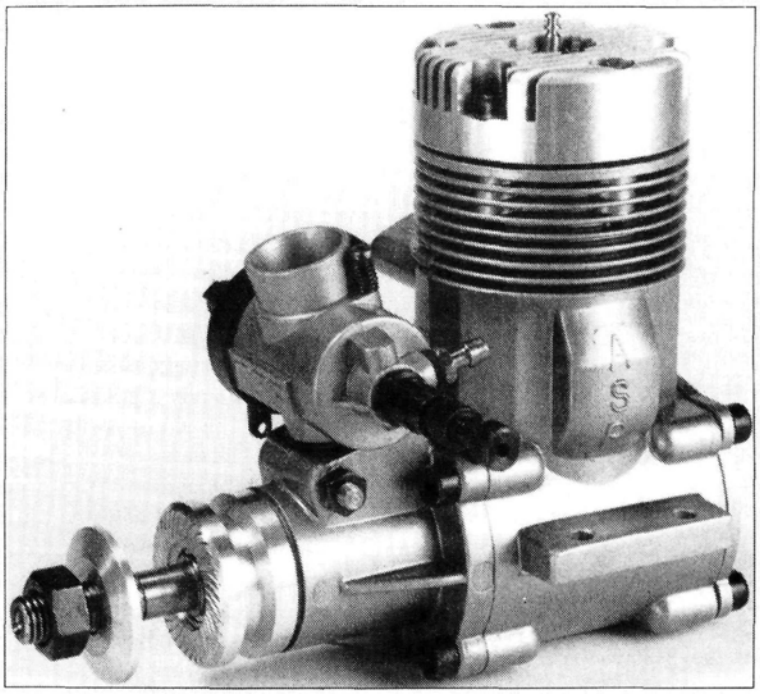
(Continued on page 110)

ENGINE EVALUATION

ASP .61

The origin of this powerful sport engine brings new meaning to the term "fine China"

by MIKE BILLINTON



Efficient, clean and solid, the ASP is good value.

RECENT HP TESTS of the ASP 40 R/C Sports ABC—one of a new range of model engines from China—proved somewhat surprising. Its low-key looks would never lead you to suspect that it's a good performer, but its designers—Mui and Leung—have obviously concentrated on essentials. The quality of ASP products is gradually improving, and the range includes 40, 46, 61 and 91 cubic-inch engines and helicopter versions of the 46 and 61. These engines are produced at two different sites, and this may explain some of the variations in external finish, but the manufacturers have ensured exemplary piston/liner combinations (always the heart of a good engine).

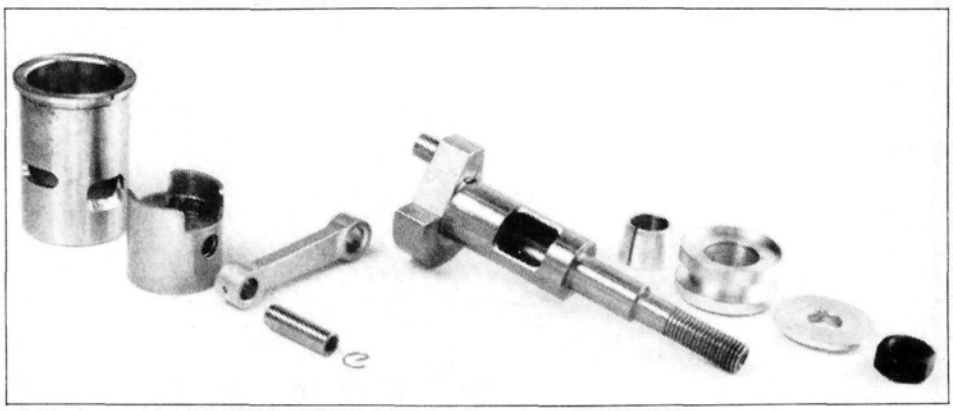
The 61 is the latest ABC version of the previously ringed 61 R/C sports engine, but now, following developments at the factory, its finish is a marked improvement on that of the earlier ASP 40. This new 61's performance is even better than the already fine performance of the ASP (relatively, around 8 percent up), and its "dyno" figures proved strikingly good—above recent S.T. X61 and Rossi five-port 61 figures and on a par with an earlier YS 60 R/C aerobatic engine. I have no figures yet on the most recent, and apparently stronger, YS 60, nor on the top O.S. units.

The Enya pumper-60 and CMB 60 will soon be tested and will give some extra information on prevailing power levels, but remember that the ASP 61 is to be considered as a "sports" engine and has a highly competitive price. It therefore shouldn't be compared directly with the "top-of-range" units for F1A R/C aerobatic competitive use—though if an engine is good, must it be expensive as well!? The production of these Chinese engines is state subsidized, so comparisons are best made on technical grounds, rather than on price.

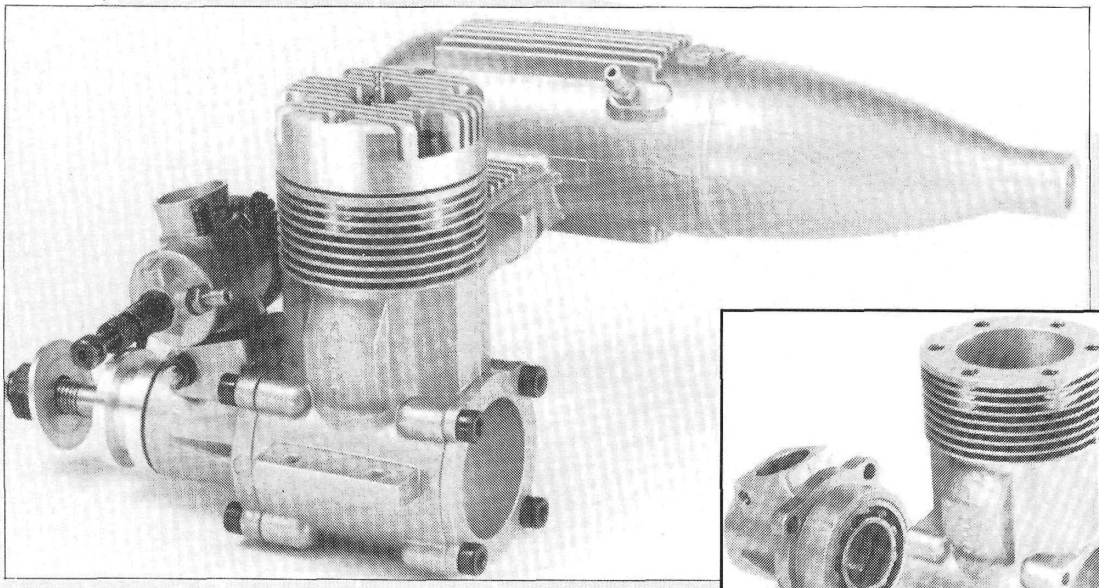
In brief, the 61 performs well, though no tuned-pipe result was obtained nor envisaged by the manufacturer. The general finish still has a way to go to reach top Japanese standards, but improvements are clearly being made.

GENERAL LAYOUT

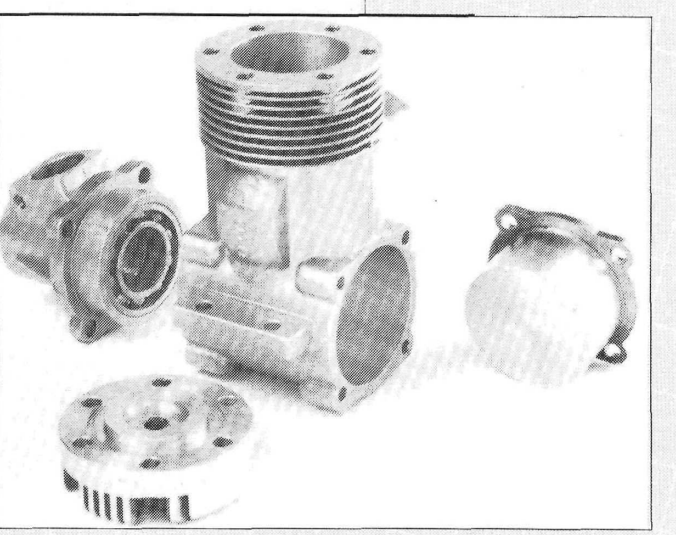
The mechanical design of the ASP 61 ABC is a familiar one: front-inducted, ABC metallurgy, Schnuerle-ported, single-cyl-



Rod configuration uses no bushings, but showed no wear at end of testing (probably owing to silicone inserts).



Left: The entire ASP package seems to have been soundly engineered and produced with quality in mind.
Below: The quality of the castings used has improved considerably since the earlier ASP Series engines were introduced. Carburetor mounting boss is sensibly robust.



inder 2-stroke, with an over-square stroke/bore ratio of .914:1—modest port timings to cylinder—156 degrees exhaust, 120-degree transfers. The blow-down period between these does suggest a possibly good tuned-pipe response, however; an average, front-induction timing of 194 degrees is used, and a modest effective compression ratio of 7.8:1 (which, no doubt, assisted trouble-free running to rpm as low as 4,000).

MECHANICAL DETAILS

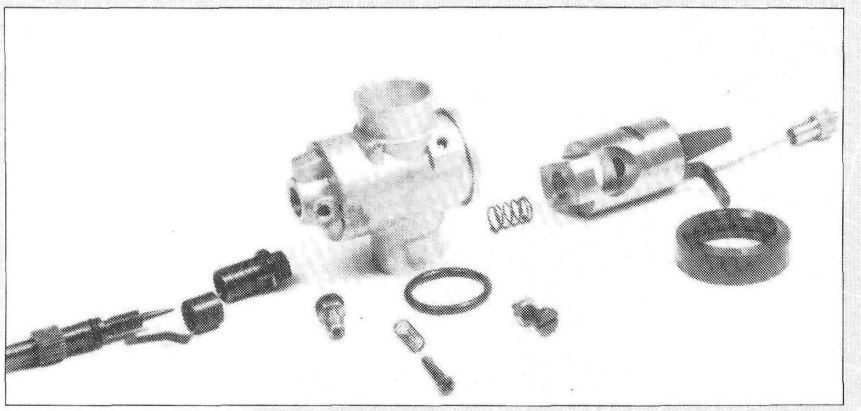
The carburetor is a solid, robust, aluminum-alloy unit with a fairly large throughway of 11.1mm and a correspondingly large 17mm steel crankshaft with an induction bore of 11.5mm (which certainly helped the ASP 61 reach its high, open-exhaust peak of 18,500rpm).

A standard, steel-barrel throttle with main and secondary needle controls is used. Parallel-sided, twin transfer passages have a wide boost passage that has a fairly restricted lower gas entry point.

The connecting rod is surprisingly rudimentary by best modern standards. It's a simple, not very good-looking casting with none of the usual phosphor-bronze bushings at the ends. At the end of my tests, however, the conrod metal (serving as the big-end bearing) showed no sign of any problem, and clearances were virtually unchanged. The metal seems to be an aluminum alloy with a low-silicon content, and it's clearly a good choice as a sliding bearing material—probably better than the more usual high-strength aluminum alloy that doesn't contain silicon.

Cylinder squish is unexceptional at .018 inch clearance and is angled up by 5 degrees. The combustion-chamber shape is a shallow "top-hat."

As with the earlier ASP 40, the ABC cylinder/piston combination is really the heart of this engine—anything *less* than the best here could well have reduced the ASP 61 to quite low performance levels. The piston is of an unusually close-grained, high-silicon alloy that runs inside a well-engineered brass liner that's chromed internally. The piston-liner fit at the beginning and end of the tests was almost identical—just a slight nip at TDC, indicating a very good wear rate. The compression seal, hot and cold, was exemplary, and running fit was free and smooth.



After the secondary needle valve (shown at extreme right) had been carefully adjusted, the carburetor allowed excellent low-speed idle of 1,800rpm.

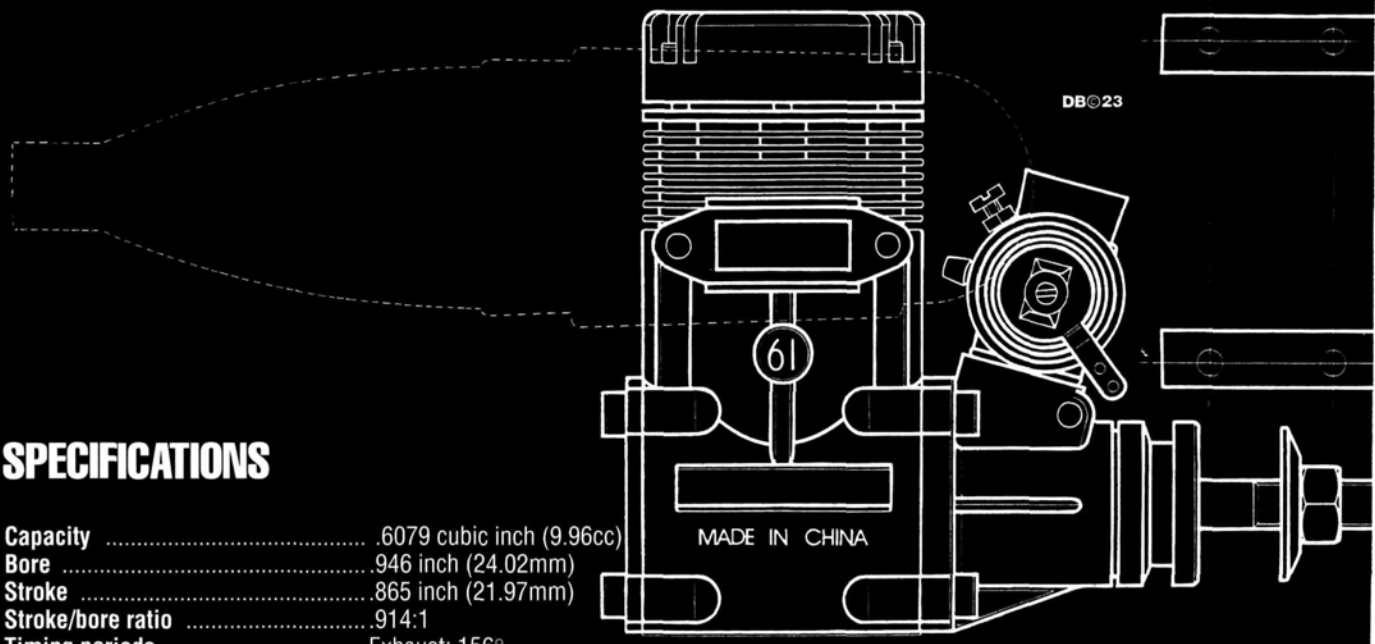
PERFORMANCE

ASP says you need only a brief break-in and familiarization on the bench before you try normal flying, and this suggests the usual laid-back attitude concerning an ABC engine's running-in period. This instruction leaflet is, however, also included with the ringed version of the ABC engine, and the advice could well be a little too casual for the ringed/iron-liner version.

Several propellers were checked for rpm during, and at the end of, the 20-minute break-in period I allowed. Working gradually toward the heavy load/low-rpm propellers during that period led to the final Mastro 18x7 allowing a steady, trouble-free 4,633rpm—an unusually low full-load figure for a 10cc, 2-stroke engine.

Comparisons with several other 10cc en-

67% OF FULL SIZE



SPECIFICATIONS

Capacity	.6079 cubic inch (9.96cc)
Bore	.946 inch (24.02mm)
Stroke	.865 inch (21.97mm)
Stroke/bore ratio	.914:1
Timing periods	Exhaust: 156°
	Transfer: 120°
	Boost:113° (angled up 53°)
	Front Induction: Opens: 34° ABDC
	Closes: 48° ATDC
	Total Period: 194°
	Blow-down: 18°
Combustion volume	1cc
Compression ratios	Geometric: 10.9:1
	Effective: 7.8:1
Exhaust-port height	.275 inch (7mm)
Cylinder-head squish	.018 inch (0.4572mm)
Cylinder-head squish angle	5°

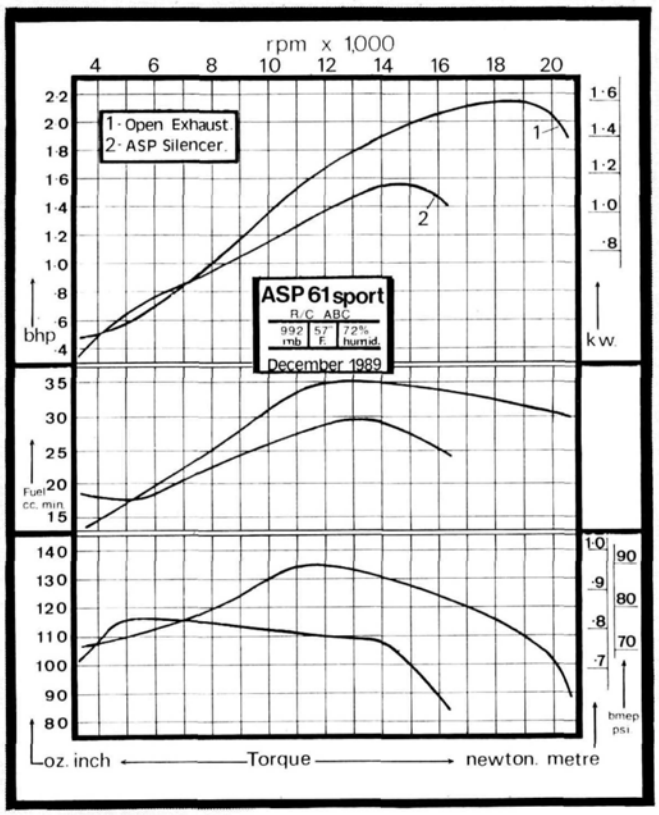
gines (sports and R/C aerobatic) showed that, like the 40, the ASP 61 was to reveal wolf-in-sheep's-clothing performance.

Test 1. Open exhaust. 10% nitromethane; 20% castor; 70% methanol; ASP glow plug.

ASP recommends 10% nitro, but makes no suggestion about oil type or percentage. Because of the low-rpm possibility shown during the propeller rpm session, I began torque tests at a much lower rpm than usual. A full-load 3,675rpm immediately showed high torque of 107 ounce/inch. Horsepower at this point is quite low, so for this reason, and fears about potential engine damage, I decided to go no lower in rpm, though it might have been possible. Torque increased up the rpm scale to a high of 136 ounce/inch at 11,497rpm. Like the ASP 40's test performance in open exhaust, the 61 continued to unwind until a final ragged 20,674rpm brought this particular test configuration to a close with 1.88hp still being generated there, and a fine 2.14 hp had been recorded further back at 18,700rpm.

Test 2. ASP Muffler. Fuel and glow plug as Test 1.

At 9mm outlet diameter, this standard back-pressure muffler caused the normal reductions in torque/hp and fuel consumption, but the really surprising finding was an extremely flat torque curve from 4,600 to 14,000rpm, which



Squish-band width ..... .178 inch (4.54mm)
Carburetor bore ..... .438 inch (11.12mm)
Crankshaft diameter ..... .669 inch (17mm)
Crankshaft bore ..... .452 inch (11.49mm)
Crankpin diameter ..... .275 inch (7mm)
Crankshaft nose thread 8mmx1mm
Wristpin diameter ..... .236 inch (6mm)
Connecting-rod centers 39mm
Engine height ..... 3.96 inch (100.6mm)
Width ..... 2.36 inch (60.mm)
Length ..... 3.67 inch (93.2mm)
Width between bearers ..... 1.63 inch (41.40mm)
Mounting-hole dimensions 20x52x4mm
Ex. manifold bolt spacing 35mm
Frontal area ..... 7.25 square inches
Weight (overall) ..... 20.3 ounces (574gm)
Weight (with muffler) ..... 4.55 ounces (129gm)
Crankshaft weight ..... 3.6 ounces (102gm)
Piston weight ..... .45 ounce (12gm)

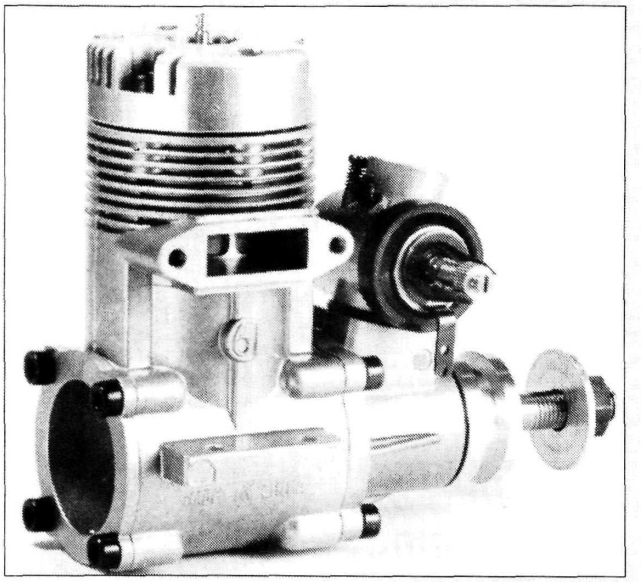
Performance:
Max. BHP
2.14 at 18,700rpm ..... (Open exhaust/10% nitro.)
1.57 at 14,315rpm ..... (ASP muffler/10% nitro.)
Max. Torque
136 ounce/inch at 11,497rpm ..... (Open exhaust/10% nitro)
116 ounce/inch at 4,645rpm ..... (ASP muffler/10% nitro)

RPM on standard (fixed-wing) propellers:

	Open Exhaust	ASP Muffer
18x7 Mastro	4,633	4,690
15x8 Graupner	—	7,042
13x10.5 MK (glass)	—	7,633
14x7 Graupner	8,400	7,983
11.5x8 MacGregor	—	9,730
13x6 MK (glass)	11,146	10,601
11.5x10.2 Yoshioka	—	10,664
12x6 Graupner	13,082	12,180
11x6 Graupner	14,780	13,830
10x6 MK (glass)	15,965	14,832
10x4 Zinger	18,016	—

Performance Equivalents:
BHP/cu. in. 3.52
BHP/cc 0.21
Ounce inch/cubic inches 223
Ounce inch/cc 13.65
Gm. meter/cc 9.75
BHP/pound 1.67
BHP/kilo 3.73
BHP/square-inch frontal area ..... .29

Manufacturer: ASP Engines, China
U.S. Distributor: World Engines, 8960 Rossash Ave., Cincinnati, OH 45236.



The exterior of the ASP .61 displays a higher degree of "finish" than its .40-size brother introduced earlier. Robust appearance.

allowed a certain strong performance virtually anywhere within that range. The factory recommendation of 11x7 or 12x6 propellers therefore seems unnecessarily narrow for such a wide potential. If, however (say for aerobatics), you want maximum *bhp* airborne, then those sizes *would* be appropriate. Otherwise, propellers with a diameter of up to 15 inches are useable and are capable of giving meaningful thrust for scale aircraft.

IDLING SPEED

Using the recommended 12x6 propeller (Graupner), muffler pressure and the test fuel allowed a steady 2,200rpm, though very careful throttle/needle adjustments made 1,800 a possibility. To achieve these figures, I had to use the supplied ASP glow plug. Attempts to use my preferred, thicker-element OPS 300-type plugs failed to equal this idling performance, with 2,800rpm being the lowest attainable idle.

SUMMARY

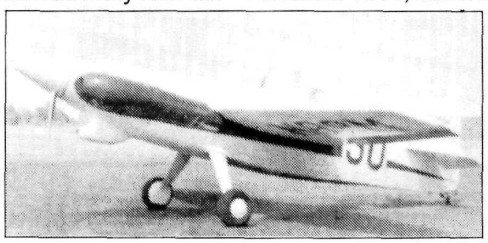
ASP's relatively new entrant in the world marketplace for model engines seems bound to cause a stir—almost certainly owing to its uniquely high "performance equivalent"—bhp:$ ratio. If its external finish and general detail work can be improved to match the best world standards—and that's a big "if"—then its sales should be high. As it is, its very simple, sound construction and useful spread of torque allied to its low price are already proving attractive to many modelers. ■

NAME THAT PLANE

CAN YOU IDENTIFY THIS AIRCRAFT?

If so, send your answer to **Model Airplane News**, Name That Plane (state issue in which plane appeared), 251 Danbury Rd., Wilton, CT 06897.

Congratulations to Marchal H. Caldwell of Macdoel, CA, for correctly identifying the Dayton Miss Dara racer shown in our April 1990 issue. His entry was drawn from only four correct answers! Come on, readers! Get back to those reference libraries! It's time to sharpen up; we're planning a full-blown racing issue for later this year, and one of the features will be a full-color look at some of these famous midget racers.



The Miss Dara drew its name from the Dayton Air Racing Association (D.A.R.A.), and it was representative of the type of Goodyear-class racers of the late '40s and early '50s. Originally designed by Edward Walker as the B&B Special, the diminutive racer crashed on its first flight because of an engine problem. It was rebuilt and successfully flown in 1951, and it went on to compete in many racing events, including the National Air Races.

Typical of the breed (which included a host of other famous racers, e.g., Shoestring, Minnow, Cosmic Wind, Rivets and Cassutt), Miss Dara used the Continental C85, 4-cylinder, horizontally opposed, air-cooled engine. As you can see, it was tightly cowled to provide an extremely slippery aerodynamic shape. The single-seater was only 19 feet long and had a wingspan of 16 feet, 9 inches.

Four weeks following publication, the name of the winner will be drawn from correct answers received on postcards delivered by U.S. Mail. The winner will receive a free, one-year subscription to **Model Airplane News**, or a free, one-year extension, if already a subscriber.

FUN-FLY SHOOTOUT

(Continued from page 103)

two other pilots had a chance of catching him: Ken Jackson was just a couple of seconds behind in 2nd; and Mac Hodges stayed in the game with a fast 3rd place. (All flew the specialty birds.)

LIMBO OR PURGATORY?

With only one event left—the famous Inverted Limbo Pass—jaws tightened and fists clenched. Why? This event is the Shootout's trademark—the terror of pilots with no guts (or no brains!). Pilots must fly their planes underneath the 5-foot-high limbo bars, which are 25 feet apart. Three successful passes would earn the golden ticket to paradise.

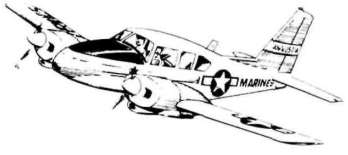
Florio pilot Richard Hook was the first to successfully negotiate the bars, but the next six daredevils bit the dust in their attempts. The ultralight specialty birds lost their advantage and were buffeted by the gusting winds—sometimes into the ground.

My Hots II was steady in the wind and made the first two trips relatively easily. I botched the third pass, a quick pull-up stalled the ship, and it was blown over the deadline and disqualified. It wasn't easy, and the heavier conventional birds eventually had the upper hand.

The ability to keep calm played a big role in this ordeal: only five pilots survived, and several opted to go home with an intact aircraft rather than attempt the risky pass. Since 75 percent of those who attempted the Inverted Limbo put their ships into the ground, I can't say I blame those who decided to avoid the carnage. In the end, Harold Parker came out with the fastest time; he was one of the few with a Yard-Dart-type ship who managed to prevent it from being blown away. Taking almost twice as long to negotiate the limbo as Parker, James Barr was 2nd, and Richard Hook came in 3rd, just a couple of seconds behind. Only 10 pilots managed to make even *one* successful pass. Tough event!

When the dust and balsa settled, the victors came forth to claim the spoils of war—and what spoils they were: kits, radios, engines, fuel, starters and battery packs. Jerry Smith, whose specialty aircraft carried him to 1st in two events, needed a wheelbarrow to carry his share to his car!

This contest was indeed a test of skill. The specialized aircraft certainly helped, but they required topnotch skills to make them perform well—especially in the crosswinds. Fun-fly pilots are, indeed, a different breed: they can fly with precision; they can soar with thermals; they can build with museum-scale accuracy. But you need *real* guts to do what these guys did in this contest. Feeling lucky? Plan on this one! ■



ROUN' TUIT

(Continued from page 37)

moving out, but handling was unexpectedly stable. I made a few passes to get used to the orientation, then I throttled back to make some passes for the camera. I went so slowly on some flybys that the Tuit would just settle down in an almost hovering descent, touch down lightly, then lift off again as power was increased.

Do not try to glide dead-stick: the Tuit's dead-stick handling is like that of a rock. For a flat landing, let the nose drop to approximately a 30-degree angle and flare (as best you can). The Tuit is durable; it survived several, hard, dead-stick landings. The instructions indicate that a reliable engine is a must.

The Tuit can be flown by anyone with basic flight skills and, although it isn't difficult to fly, it can do some really interesting stuff. For landing, approach with 1/4-throttle at an elevation of 5 to 10 feet, reduce throttle and feed in up-elevator: it will practically stop its forward motion and hover into a landing. For takeoff, throttle up and pull full up-elevator: it will rotate straight up. Since the Tuit has no wing tips, it can't tip-stall!

Bonded Model Products also includes a warranty on the Roun' Tuit: basically, if you build your Tuit as depicted in the drawings and follow the instructions, but you aren't satisfied with its performance, you can return it for a full refund. I can say that I have just what the manufacturer said I'd have: an unusual, stable, predictable, durable, agile, enjoyable aircraft. I don't have any more excuses, either, because now I've gotten a Roun' Tuit!

**Here are the addresses of the companies mentioned in this article:*
Bonded Model Products, P.O. Box 10998, Austin, TX 78766.
***Satellite City,** P.O. Box 836, Simi, CA 93062.*
***Carl Goldberg Models,** 4734 W. Chicago Ave., Chicago, IL 60651.*
***Hobby Shack,** 18480 Bandilier Circle, Fountain Valley, CA 92728.*
***World Engines,** 8960 Rossash Ave., Cincinnati, OH 45236.*
***O.S./Great Planes Model Distributor,** P.O. Box 4021, Champaign, IL 61820.* ■

MODEL AIRPLANE NEWS

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CALIFORNIA—Torrance/Gardenia
Your one-stop R/C shop. We try to carry it all. Major items discounted. Help and advice free. Building and bull sessions allowed on premises. Near LAX. Owner: John Eaton.
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Findlay's local R/C dealer, planes—cars—boats. We specialize in R/C, large selection of kits, accessories, and parts. We are authorized Sig and Dremel dealers. Also sell plastic kits and model rockets. Tue. & Thu. 3-9, Mon., Wed., Fri., & Sat. 10-9.
JINX MODEL SUPPLIES
721 Rockwell Ave. **422-5589**

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WINGS 'N THINGS HOBBY SUPPLY, INC.
5241 S. Peoria Ave. **745-0034**

TEXAS—Austin
Austin's largest hobby shop. Complete line of R/C airplanes, gliders, cars, boats, helicopters, parts & accessories, rockets, kites, R/C systems. Centrally located. Open 7 days a week.
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LARRY'S HOBBIES
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GUARANTEED Lowest prices on Concept 30, G.M.P., Kalt, Schluter, and X-CELL Helis, parts, accessories. Radios, Gyros, tools, etc. Other R/C products also available. 9-7 Mon.-Sat. MC/Visa welcome.
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LATIN AMERICA
COSTA RICA—San Jose
Complete line of R/C airplanes, cars, boats, and helicopters. Parts and professional expert service and advice. Julio Pastura, President. Weekdays 4-10 p.m.
EL HOBBY SHOP
Centro Commercial, San Jose 2000
Apartado 529, Centro Colon **32-26-81**

Send sales message and payment to **Model Airplane News Hobby Shop Directory,** 251 Danbury Rd., Wilton, CT 06897.

For further details or information on our special introductory offer, call toll-free 1-800-243-6685 and ask for Katherine Tolliver.

FLOATING AROUND

(Continued from page 52)

readers that I'm talking about a particular plane's performance on floats, and the comments presented here don't apply to land-based operation. The Waco sounds like a lot of .60-size scale projects—lovely to look at, a little testy to fly, but worth it in the end.

TOO LATE TO CLASSIFY

Jimmy MacDanald just walked in with a book and a video of interest to Beaver aficionados. Put out by the EAA*, the 55-minute video by Norb O'Keefe, is entitled "Beaver Country," and it has some interesting historical footage on the Beaver's development. It also has a complete flight-instruction sequence using a Beaver that was completely restored and extended 36 inches by the people who manufacture Whipline Floats.

The book Jimmy brought over is called "Bush Flying"* by David Oliver. Its 126 pages are packed with color photos of bush planes, and about 90 percent of them are on floats. This book won't disappoint you! It contains the finest floatplane photography I've seen anywhere, and some of the twin Otter step-planing shots are simply breathtaking. The video is a little pricey ($39.95 for 55 minutes), but the book retails for around $15—a great investment for color documentation or for just dreaming.

**Here are the addresses of the manufacturers mentioned in this article:*
Unionville Hobbies, *P.O. Box 135, Markham, Ontario, Canada L3P-3J5.*
Bob Schweisinger, *131 East Ave., Sutherlin, OR 97479.*
Bill Evans Aircraft, *4545 Wildrose Ln., Bishop, CA 93514.*
Carl Goldberg Models, *4734 West Chicago Ave., Chicago, IL 60651.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*
EAA Aviation Center, *Whittman Airfield, Oshkosh, WI 54903-3065.*
"Bush Flying," *Motorbooks International, Osceola, WI 54020.*
Zenoah; *distributed by World Engines, 8960 Rossash Ave., Cincinnati, OH 45236.* ■

FAST EDDIE

(Continued from page 56)

nately, I made too tight a turn with the power off, and the model immediately fell from about 20 feet. The wing wasn't damaged, but fuselage repairs took about 2 hours.

During the bench time, I added an air

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FAST EDDIE

(Continued from page 116)

scoop (made from a plastic spoon) to the fuselage side. The air flow eliminated the overheating problem. I also reduced the aileron throw to 1/4 inch up and down, as less sensitive roll control is more suitable for my experience and taste.

Over the next dozen flights, the Fast Eddie helped me learn to perform aerobatic maneuvers that aren't possible with sailplanes. It flies inverted and performs inside loops, consecutive rolls and Immelman turns—although in my case, not every maneuver was planned! On the fifteenth flight, I flew into the ground under power while practicing inverted flight. This second crash, owing entirely to pilot error, cost 4 hours on the bench. During *this* repair time, I added two layers of 2-ounce fiberglass cloth to the bottom of the fuselage. This modification adds about an ounce to the model's weight, but makes the fuselage stronger.

The Fast Eddie is quick and very responsive to the controls—my definition of "exciting to fly"! I don't know about experienced aerobatic pilots, but old glider pilots like me can't take their eyes off the model, even for half a second! On the other hand, the airplane is very easily controlled, and I saved it from crashing a dozen times by flying out of a predicament. The trick to practicing unfamiliar maneuvers is to have plenty of altitude so that you have time to recover from any error.

EDDIE'S FIRST REPORT CARD

The Fast Eddie is a bargain. It cost $70.34 to build the model; this includes $24 for the kit, $9.50 for a roll of heat-shrink covering, $19.95 for the motor, $10.95 for the folding propeller, $1.95 for the prop mounting hub and $3.99 for a spinner. Not included in this total are adhesives, paint, a motor battery pack and a radio set.

The Fast Eddie is easy and quick to build, and the kit is complete except for adhesives and covering. The model is small enough to build on a small bench, and it's easy to transport in the car.

The Fast Eddie flies wonderfully. It isn't a trainer (or even an aileron trainer), but if you're confident flying with aileron and elevator controls, this airplane is tons of fun!

(Continued on page 123)

SPORTY SCALE

TECHNIQUES

by FRANK TIANO

Fabulous fortress, scale supply and realistic radials

On this DC-3/C-47, the use of airliner livery—Northwest, in this case—is a nice change from the more commonly seen military markings. Wayne Siewart uses a pair of .40s to power his version, which he built from the Royal kit.

UNCLE BOB'S BOEING BELLE BOMMA

THROUGHOUT the world, there are probably three or four airplanes that are known by nearly everyone who can read:

- the P-51 Mustang (any single-engine, prop-driven fighter with a star-and-bar insignia)
- the venerable Messerschmitt (any prop-driven fighter with black iron crosses adorning its airframe)
- one of my all-time favorites, the Sabre Jet (the nickname for any aircraft with no visible means of propulsion that bears the U.S. national insignia)
- and, last, but not least, the infamous B-17 Flying Fortress (any large, military-looking airplane with four propellers).

Well, one day last year, Bob Campbell's doctor let him out on a three-day pass with 400 board feet of balsa, a couple of sheets of plywood and some tires. Armed with all this, a roll of kitchen shelving paper and a handful of Bics, Uncle Bob built him a Bomma. Now, this was no ordinary Bomma, but a real 1/7-scale rendition of one of the most famous Bommas of all time—that's right, none other than the B-17 Memphis Belle!

This is a perfect example of what someone can do with a little ambition, a little skill, a six-car garage and a monthly check from the Ohio State Lottery. Uncle Bob's Belle spans 16 feet, 4 inches, weighs 98.16 pounds and is powered by four 2.4-cubic-inch Kioritz engines. It was constructed in 1,200 hours from foam and balsa, covered with 75 feet of MonoKote* and uses 15 Futaba* servos hooked up to an 8-channel PCM for control.

Don't bother running for the phone: Uncle Bobby is *not* selling plans for this Bomma; he is *not* making turrets and stuff; he is *not* offering his custom-made landing gear for sale; and he has *no* plans to kit this thing. I just wanted to share with you the results of one man's labor of love...or is it love of labor?!

Bob Campbell poses with his monster B-17, "Memphis Belle." Huge model was completed in 5 months! If Bob seems tired, you can understand why! Weight of this 16-foot-span machine is just shy of the century mark!

ROYAL OFFERINGS

Before 12 feet of snow set in, Wayne Siewert took a snapshot of his little (by Campbell's standards!) DC-3 built from a Royal* kit. Wayne's version looks really handsome with its Northwest Airlines markings and three-blade props. With the introduction of reliable radio and engine equipment over the past years, projects like this are becoming more and more common. Wayne says this model flies beautifully on a pair of .40s and was fairly easy to construct.

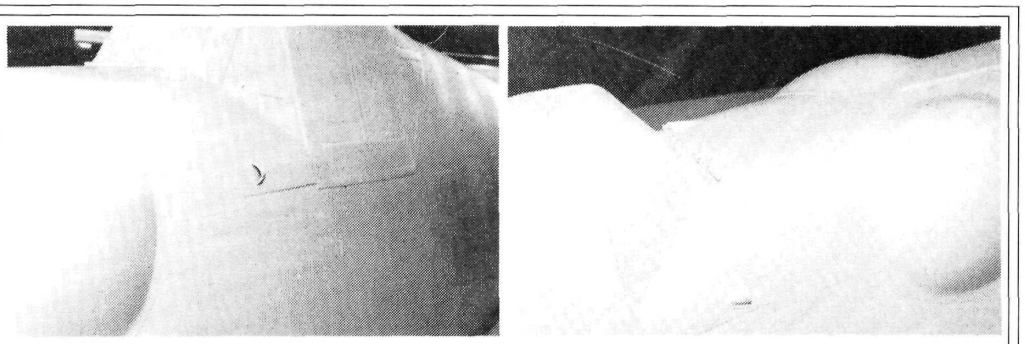
We often overlook Royal as a scale source, but maybe we should take a better look at its line. Just in case you've had a memory lapse, Bill Miller nearly won the U.S. Scale Masters with one of these kits, twice! Best of all, besides having dozens of airline color schemes from

which to choose, there are almost that many military versions from all over the world, including the original "Puff the Magic Dragon" gunship used in Nam.

TIPTOE THROUGH THE VIOLETTS

After much prodding from many modelers and yours truly, Bob Violett has just formed a new company called Violett Supply* that offers all the little doodads that, until now, you could only find in one of his kits.

He still offers his successful line of Magnalite carbon-fiber material, as well as fans, engines and pipes; but he has added all kinds of new stuff. For instance, you can now buy pre-joined wing skins in either 12x41- or 14x47-inch dimensions. These skins come in 1/16-inch thickness only, but they're perfectly joined and require minimal sanding, so they're as useful as any 3/32-inch stuff that has to be block-sanded down to about 1/16 inch anyway.



Top Gun contestant Denny DeWeese has gone all out on his Platt Bf-109G: he added scale air scoops, raised panels and even a windscreen anti-ice spray bar. Scale building is becoming an art form!

Violett also has fiberglass sheets in assorted sizes; Mighty Lite in assorted sizes; 87- and 90-degree straight retracting retracts; 90-degree rotating retracts; scale landing-gear struts; Fascal iron-on film; K&B paints and thinners in large, economy sizes; assorted sizes and shapes of carbon-fiber brackets, servo trays and blade spars—the list goes on! No scale modeler should be without this catalogue; it can be yours for just $2 and a SASE.

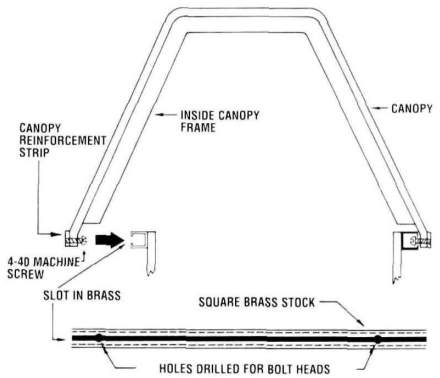
I've seen the prototype of BVM's new F-16 fly; with the scale landing gear, it's truly awesome. The kit will retail for about a grand, but it will include *everything* needed to complete the kit (including those special folding retracts), except the power module.

DETAILS, DETAILS...

For the last two months, Denny DeWeese, Charlie Chambers and Don Smith have been working on their Top Gun airplanes in my workshop. Good thing I have a rather large shop! I took a few photos of Denny's ME-

(Continued on page 122)

CLOSING THE "OFFICE"



There are several ways to make your canopy slide open and closed, but I've found this is the easiest. (It won't work on a bubble-type canopy, however; I'll cover that next time.)

Cut a slot in the appropriate-size, square, brass tubing, and drill a couple of holes through which the heads of 4-40 bolts will pass. Secure the rails to the fuselage, and glue a stiffener to the inside (or outside) of the lower canopy frame (depending on your canopy style). This canopy reinforcement strip should be made from something that can be tapped for 4-40 bolts and that will hold the thread for a long time (e.g., a 1/16-inch, poly-ply, fiberglass sheet from Violett Supply, or 1/16-inch aluminum).

Insert the 4-40 bolts in the tapped holes so that the heads just clear the inside of the canopy rails. After you place the canopy on the rails and slide it forward, the rail sides will capture the bolt heads and tightly hold the canopy to the fuselage. To remove the canopy, simply slide it rearward until the bolt heads line up with the holes you drilled, and the canopy will pop off. Mike Bacon's sketch should clarify this explanation.

add-ons can make a model much more realistic.

Notice the drilled aluminum tubing that's installed around the front of the windshield. This was meant to shoot antifreeze on the windshield to de-ice the windscreen. Check out those panel lines and slightly raised panels. The raised panels were done with aluminum tape or with layers of lacquer putty built up inside a shape outlined with two or three layers of masking tape. The panel lines were made by laying down 1/32-inch crepe drafting tape, shooting several *light* coats of paint over them, sanding lightly and then removing the tape to produce an indented joint line rather than a "humped" one. An extra evening's work gives you results that will make people think that you've spent weeks, not hours!

Well, that wraps it up for this month. Next time, I'll look at some propeller/enginecombinations, maybe some metal covering techniques and more of our readers' projects. I'm sure I can scrape up another "how-to" and some new products of which you should be aware.

Until then, please keep this very important information at the top of your scale-modeling list. "Fail safe" does *not* mean that your radio failure will be a "safe one"; and unless you wear your shoes backwards, gluing small mirrors to the tips of your shoes probably won't help you check your six!

**Here are the addresses of the companies mentioned in this article:*
MonoKote; *distributed by Top Flite, 2635 S. Wabash Ave., Chicago, IL 60616.*
Futaba Corp., *4 Studebaker, Irvine, CA 92718.*
Royal Products, *790 West Tennessee Ave., Denver, CO 80223.*
Violett Supply, *1373 Citrus Rd., Winter Spring, FL 32708; 1-800-899-1144.* ■

FAST EDDIE

(Continued from page 119)

**Here are the addresses of the companies mentioned in this article:*
Midway Model Co., *P.O. Box 9, Midway City, CA 92655.*
Monokote, *distributed by Top Flite Models, 2635 S. Wabash Ave., Chicago, IL 60616*
Kyosho/Great Planes, *P.O. Box 4021, Champaign, IL 61820.*
Sonic-Tronics, *7865 Mill Rd., Elkins Park, PA 19117*
Carl Goldberg Models, *4734 W. Chicago Ave., Chicago, IL 60651*
Sanyo Electric, *Battery Division, 200 Riser Rd., Little Ferry, NJ 07643.*
Futaba Corp. of America, *4 Studebaker, Irvine, CA 92718* ■

GIANT STEPS

(Continued from page 76)

this leads me to believe he has more up his sleeve than just an arm. If you want to do some racing, stuff Crash's mailbox with queries; he'll give you the details.

PICK A PATTERN PILOT'S BRAIN

In my last column, I wrote about trimming a new model—an often neglected part of flying that's just as important for large models as it is for the more conventional ones.

When I wrote about the static aspects of balancing, I said that contest pattern fliers usually know a lot about aerodynamic balancing. A model that has a slightly heavy wing or wanders out of a perfect loop isn't good enough. Good pattern fliers know how to flight-trim a model properly. Although you might not be interested in flying pattern contests, you can learn a lot from those who are.

If you have an airplane that has been static-balanced properly, and you're still unhappy with its performance, ask a pattern flier for advice. Minor changes in wing and stab incidence and small changes in control throw and neutral positions can greatly affect the way a model flies. Here again, a pattern flier may be able to make suggestions. I've known pattern fliers who could make improvements to a model after flying it for only 5 minutes.

What if a model wanders or performs erratically in calm conditions? A good pattern flier can correct this problem in a few minutes. What about mounting the engine properly so that sudden throttle changes don't cause severe problems? A slight amount of downthrust may be required to prevent a sharp "ballooning"

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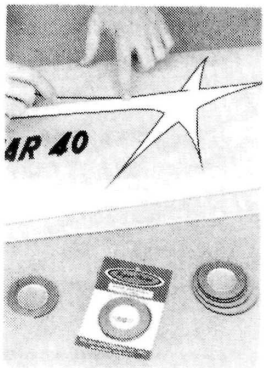
PRODUCT NEWS

Descriptions of new products appearing in these pages were derived from press releases by the manufacturers and/or their advertising agencies. The information given here does not constitute endorsement by **Model Airplane News**, or guarantee product performance. When writing to the manufacturer about any product described here, be sure to mention that you read about it in **Model Airplane News**.

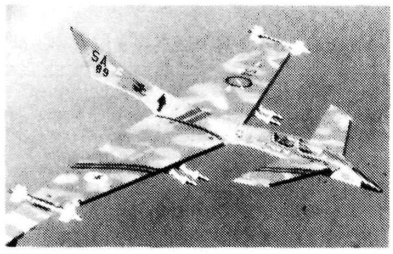


SIG MANUFACTURING
SuperStripe Trim Tapes

SuperStripe high-gloss trim tapes are very thin and work well over painted and plastic-film surfaces. The tape is made with a special elastic polymer so that it bends easily around any type of compound curve. The adhesive on the tape is fuelproof: when factory-tested with raw fuel, it stayed tightly attached even when attempts were made to force fuel under the seams. Even when the area was washed with methanol, the tape stayed tight. SuperStripe is available in orange, silver, yellow, dark blue, black, white, medium blue and red.

Price: $1.99 to $4.25/36-inch length (width: 1/16 to 1/4 inch))

For more information, contact Sig Manufacturing Co., Inc., 401-7 South Front St., Montezuma, IA 50171.



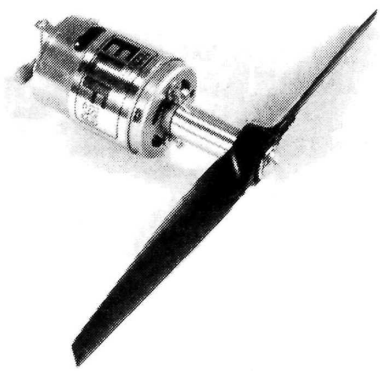
JAREL
Telos

Jarel introduces Telos—the world's first R/C slope canard sailplane that's designed to be aerobatic. Flight characteristics include high speeds, rapid roll rates, inverted flight and outside loops. Flown slowly, it can be hovered to a landing spot, and its canard design helps eliminate tip stalls. With its wide flight envelope, this ship is great for pros and novices alike.

The kit includes: Kevlar/carbon-fiber composite fuselage, including molded vertical fin; blue foam main wing and canard cores; balsa wing sheeting and spruce leading edges; molded clear canopy; precision-machined wooden parts; complete hardware; illustrated instruction book and composites guide; full-size drawings; and carbon-fiber spar material.

Wingspan: 52 inches (main), 24 inches (canard); fuselage length: 37 inches; airfoil: modified quabeck; wing area: 351 square inches (main), 90 square inches (canard); all-up weight: 28 ounces; radio: 2-channel; wing loading: 9 ounces per square foot.

For more information, contact Jarel Aircraft Design and Engineering, 12136 Braddock Dr., Culver City, CA 90230.

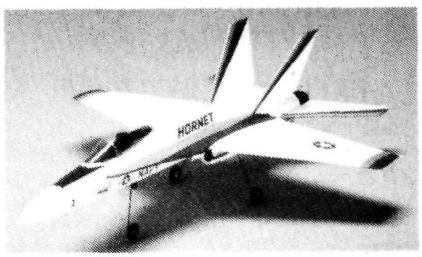


HI LINE LTD.
ELF-50 Motor

Hi Line's new motor—the ELF-50—weighs about 2 3/4 ounces and is designed to power small R/C models that have a wing area of 300 to 400 square inches and weigh approximately 16 to 22 ounces. This 50-watt motor uses a 4-cell battery for power and is a good match for 6x4 to 7x4 propellers. The ELF-50 is also available with a wiring harness that includes a connector, switch and fuse for $19.95. A catalogue of all products is available for $1, plus postage.

Price: $15.95.

For more information, contact Hi Line Ltd., P.O. Box 1283, Bethesda, MD, 20817.



EZ SPORTS AVIATION
F-18 Hornet

For experienced modelers and fliers, EZ Sports Aviation announces a revolutionary ARF R/C "jet" that eliminates the hassles associated with ducted-fan models. Its pusher-prop design means the engine is hidden inside the tail, so it's easier to reach (for servicing and cleaning) and easier to start. The EZ F-18 Hornet is light, stable, aerobatic, and has an excellent thrust-to-weight ratio. This plane is 54.7 inches long, with a 43.7-inch span and a 480-square-inch area. It weighs 105.8 ounces and requires a .45 to .46 engine and a 4- to 5-channel radio. It comes in F-18 factory colors—white with navy and gold trim. Optional tricycle retracts (part no. 101097) are available for $87.98.

Part no. 100973.

Price: $500.

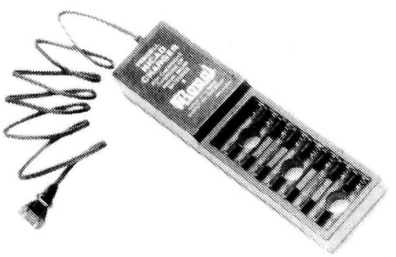
For more information, contact Global Hobby Distributors, 18480 Bandilier Circle, Fountain Valley, CA 92728-8610.

PACER TECHNOLOGY
Z-Poxy Finishing Resin

Pacer Technology announces the release of its newest product, Z-Poxy Finishing Resin, which replaces the recently discontinued Loctite Finishing Resin. Z-Poxy Finishing Resin offers fantastic performance from an equal-mix, relatively odorless, fast-curing product that's a welcome alternative to smelly, polyester resins. Its easy-to-sand formula is ideal for laminating, sheeting foam wings or for fiberglassing. It may be used to make fiberglass parts or to form fillets, and it cures in approximately 70 minutes. Its surface may be sanded in less than 4 hours.

Price $13.99/12-ounce package.

For more information, contact Frank Tiano Enterprises, 2460 SW 85th Ter., Davie, FL 33314.

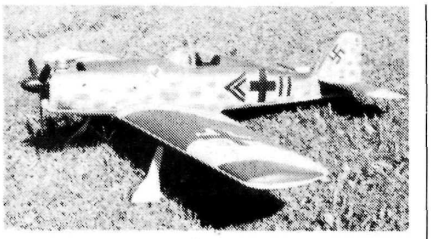


ROYAL PRODUCTS
Pencell Charger

This unit can charge four or eight AA-size pen-cell batteries, and it's ideal for charging the Ni-Cds used to convert 2-channel systems from dry to rechargeable batteries. It has dual charging indicator lights and is designed for safe overnight operation.

Price $17.95.

For more information, contact Royal Products Corp., 790 W Tennessee Ave., Denver, CO 80223-2875.

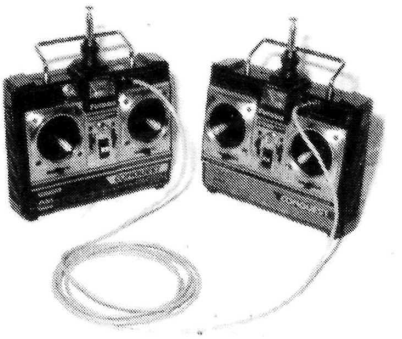


DAVEY SYSTEMS
Focke-Wulf FW-190

Davey Systems' new sport-scale Focke-Wulf FW-190 is a 51-inch-wingspan version of the Luftwaffe's best fighter bomber of WW II. The kit contains select, accurately die-cut and machine-cut balsa, ply and hardwood parts; hardware; and preformed landing gear. Also included are step-by-step instructions, rolled plans and precut fuselage sides and tail feathers. This kit can be built as a sport/pattern bird or as a beautiful standoff-scale model with flaps and retracts. The wing area is 510 square inches, and its flying weight is 5½ to 6 pounds for .45 to .60 2- or 4-stroke engines. The FW-190 has ample room for a large electric motor and the required batteries.

Price $99.95.

For more information, contact Davey Systems Corp., 675 Tower La., West Chester, PA 19380.

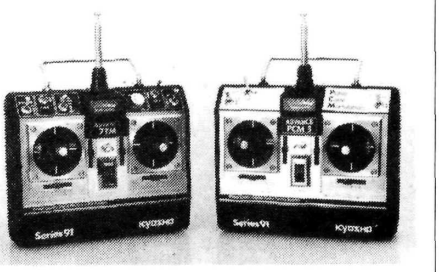


A.R.B. COMPANY
The Buddy System

The Buddy System is an exciting new product that will revolutionize R/C training procedures. It's the first—and only—low-cost R/C trainer system that's designed to be installed in Futaba and Airtronics radios using the same channel. It can also be retrofitted and used with any other radio system. Installation can be completed in about 30 minutes by anyone who can solder two wires together. It's easy to use; it costs considerably less than the cost of repairs from just one crash; it greatly increases safety during student training; and it allows instantaneous switching between radios.

Price: $34.95 (plus $3 shipping & handling)

For more information, contact A.R.B. Company, 8825 Roswell Rd., Suite 613, Dunwoody, GA 30350.



KYOSHO
Advance Radios

Kyosho now offers 5-channel PCM and 7-channel FM radio systems. These reliable radios provide increased security against frequency interference within the 20kHz channel separation. Both Advance systems feature four KS100 servos with 38 ounce/inches of torque. They allow servo-reversing on all channels and dual conversion receivers with excellent narrow-band characteristics. A variable-hold fail-safe function increases the PCM5's dependability, and both systems include aileron and elevator dual rates. Control-stick height and tension can be adjusted. A full set of Ni-Cds for both transmitter and receiver is included.

Part no. KYOJ30 (5-channel PCM); KYOJ40 (7-channel FM).

Price: $299.95; $319.95.

For more information, contact Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

CLUB OF THE MONTH

THE AEROHAWK RADIO MODELERS

Excitement and optimism come with the start of each new flying season, and our Club of the Month—the Aerohawks of Iowa City, IA—has the right spirit. Actually, they've been into it since February, when they had some fluky 70-degree days!

Getting ready for a busy summer, the club has taken lots of orders for fuel. If the orders keep rolling in, the member in charge is going to be buried under cases! Modelers are putting the finishing touches on their planes, and the club is eager to recruit new members to "wear the colors." They're boosting group pride by printing shirts and jackets with the Aerohawk logo. They want to look good at upcoming club functions, fun flys and mall shows—or maybe it's a publicity stunt!

But smart R/Cers know that you can't get too carried away; the weather reports may sound good, but your flying skills might not be up to par. Newsletter editor Denny Ward cautions his fellow fliers to remember they may be rusty from their 5-month hiatus. For those who are flying solo for the first time, he recommends that they limber up their "stick fingers" and look up an old friend—their flight instructor! You don't want to start the season with a bad experience—i.e., the "C" word—so don't overdo the hot-shot maneuvers right away!

The author of a column in the "Aerohawk Radio Flyer" called "Gary's Propwash" prepared for the new season in his own way. Gary's been using Dave Brown's Flight Simulator and finds it more difficult to "fly" than the real thing. That's good, because while all you risk on the computer screen is your "pride and ego," in real life you might lose wings, fuselages, props, etc.! He recommends the flight simulator as a teaching tool for new pilots, and as an experiment, his kids are trying it.

By now, the Aerohawks are into their events, breaking club records and earning points with each fun-fly contest. So what did you decide, Aerohawks?—trophies, prizes or cash for the top flier at the end of the season?—or are we getting ahead of ourselves? After all, the season's just begun! Enjoy the flying—and enjoy your two free MAN subscriptions! Congratulations, Aerohawks, for being our Club of the Month!

GIANT STEPS

(Continued from page 123)

climb when throttle is increased.

I hope I've given you a few ideas about where to look for solutions to your problems. Good flying and soft landings.

Here's the address that's pertinent to this article:* ***Crash Evanson,* *770 Wells St., St. Paul, MN 55106.* ■

BUILDING MODEL PLANES

(Continued from page 81)

standards. So-called 1/8-inch plywood is really 3 millimeters thick—just .007 inch under its nominal inch dimension. This isn't a lot, but if you're fitting a ply part such as a landing-gear bulkhead into a slot between two fuselage doublers, make sure the slot isn't too loose a fit. Snug joints are the strongest!

Birch ply is available as thin as .020 inch (0.5 mm). Called 1/64-inch ply (though it's really 28 percent thicker than that), it can be cut with sharp scissors. It's an excellent way to strengthen balsa model parts; just glue it to their surfaces. This adds little weight (a sheet of 1/64x6x12-inch ply weighs a mere 6/10 ounce), but the strength gain is immense—particularly if the balsa and ply are firmly bonded together.

Unfortunately, this isn't easy to accomplish with most modeling adhesives. Never try it with a water-thinned glue; the moisture causes uneven expansion, buckling and warping. CAs work OK, but it's difficult to apply a smooth, even film over a large area of wood and to press the two parts together firmly and evenly all over. Epoxy would be good for a job like this, except for its weight and difficult clean-up.

I've come up with an easy, effective method, though. Remove all dust from both surfaces, and brush a thin, even coat of Balsarite on the balsa and a similar coat of Quik Stik on the plywood (both adhesives are made by Coverite*). Using an iron as if you were applying covering, join the two parts. (This glue-up job can be done using rough-cut wooden pieces, which can be shaped to final contour after they're bonded together.

You can't reinforce a compound-curved balsa surface with plywood using this method (or any other that I know of), but for single-curvature parts such as wing center sections, it's an ideal way to add tremendous strength without much weight.

**Here are the addresses of the companies mentioned in this article:*
Mighty Lite*; distributed by Frank Tiano Enterprises, 2460 SW 85th Terrace, Davie, FL 33324, or* ***House of Balsa,*** *20130 State Rd., Cerritos, CA 90701.*
Coverite, *420 Babylon Rd., Horsham, PA 19044.*
Loctite Corp., *4450 Cranwood Court, Cleveland, OH 44128.* ■

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Send ad and payment to *Model Airplane News*, 251 Danbury Rd., Wilton, CT 06897. **Non-Commercial classified ads** (commercial ads of any kind not accepted at this special rate). Rate: 15 words or less, $4.50 payable in advance. No charge for name and address. Additional words, 25¢ each. **Commercial classified ads** (rate applies to anyone selling on a commercial basis–retailers, manufacturers, etc.) Rate: 50¢ per word, payable in advance. Count all initials, numbers, name, address, city and state, zip and phone number. **Closing Date** for either type of ad is the 20th of the third preceding month (for example, January 20th for the April issue.) We do not furnish box numbers. If you would like your ad run in more than one issue, multiply amount of payment by number of months that ad is to run. It is not our policy to send sample copies of tear sheets.

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WANTED: Model engines and race cars before 1950. Don Blackburn, P.O. Box 15143, Amarillo, TX 79105, (806) 622-1657.

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